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Duplicate bin system, curtains and heaters permit sand to be kept in condition to ship all through the winter months

Canvas curtains raised for truck loading — four of the company's fleet of 14 motor trucks

Plant of the Red Bank Gravel Co., Cincinnati, Ohio, described in succeeding pages as a model city trucking plant

View of complete operation at Red Bank Gravel Co., Cincinnati, Ohio. The locomotive crane at the right loads the car that is drawn by a hoist to the foot of the plant conveyor

The Latest in City Trucking Gravel Plants

Unusual Sand Washer and Bin System Are Some Features of the Red Bank Gravel Co.'s Plant at Cincinnati, Ohio

THE operation of the Red Bank Gravel Co., which is at 5225 Eastern Ave., on the edge of Cincinnati, Ohio, is an illustration of how important trucking operations have become in the sand and gravel industry. Without railroad shipments (for which there are no facilities) this plant has shipped as high as 1500 tons per day, and could have increased this figure. The potential capacity is around 2000 tons per day working a night shift, as is the custom in the peak of the shipping season, and it will not be surprising if the shipments equal this figure during the coming year.

This business is one of the many interests of Fred Cornuelle, who is well known in the sand and gravel industry of the Middle West. Quite recently he acquired a large interest in the Ohio Gravel Ballast Co., one of the very large sand and gravel enterprises of the country, and is now its vice-president and general manager. Those who attended the Cincinnati convention of the National Sand and Gravel Association will remember his paper on constructing a plant for trucking delivery (which follows this article).

Both the method of excavating the bank material and the plant at this operation are unique. The washing plant is especially so for it has been built around a sand-washing and screening device of Mr. Cornuelle's invention.

The face of the bank as worked at present is from 60 to 80 ft. high, and ground water level is a short distance below the present pit floor. The bank is quite evidently of glacial material, stratified by seasonal flows, and runs about 60% sand and 40% gravel —the usual proportion found in the glacial deposits of this part of the country. In order to obtain an even quality of feed to the plant, the bank is worked all the way up and down the face as a unit. Workmen core it down so that it falls in a heap at the bottom and this heap represents everything in the face from bottom to top.

This loose material is picked up by a Northwest locomotive crane with a 1-yd. bucket and loaded into a 4½-yd. Western side dump car. The car is drawn to the plant over a short piece of straight track by a 20-hp. Mundy hoist. This part of the operation was being changed, when the plant was visited recently, from another method of material handling—abandoned because of greater expense, so the pictures show the 20-hp. hoist just being moved into place.

The car is dumped into a small hopper below the level of the track, on top of which is a bar screen with 6x8-in. openings. Stones too large to pass this have either to be sledged or taken in trucks to the crushing part of the plant, but the bank contains very few pieces that will not pass an opening of this size. The car is returned to the hopper by the same hoist.

Extension of Excavating System Provided for

The system of excavation and recovery, of caving the bank, and loading into a car that is pulled in and out by a hoist, is one that can be extended without much difficulty. When the track gets too long to admit of easy transportation it can be swung into the bank and the locomotive crane can work through to the hopper on a return path.

Before the ground is excavated it is stripped by an Erie steam shovel with a ¾-yd. dipper. Stripping is loaded into Western side-dump cars and drawn away for disposal by two 7-ton Plymouth gasoline locomotives.

The bank material from the hopper is fed by a Webster apron feeder to a 22-in. belt conveyor, which is 172 ft. centers and rises 70 ft. to the head of the plant. Here the material is discharged into a scalping screen 8 ft. long in the screen section and 4 ft. in diameter, perforated with 2½-in. round holes. It is driven by a 30-hp. triumph electric motor through a Jones speed reducer. Water from a 6-in. pump is applied by sprays in this screen. The oversize goes by a chute from the screen to a stockpile from which it is picked up and sent to the crushing plant.

Scheme to Get Dry Stone for Crusher

This unusual arrangement was deliberately adopted in order to get dry stone for the crusher. The crushed boulders are sold as a separate product and not mixed with the gravel as is the ordinary practice in plants of this kind.

The crushing plant contains a No. 4 Good Road Machinery Co.'s plate frame jaw crusher followed by a Symons disk crusher, without any screen between the two. Both are driven by Howell motors. The crushed product is taken from the disk crusher by a 24-in. bucket and belt conveyor and sent to a revolving screen which makes four sizes of stone which are called 2-in., 1-in., ¾-in. and screenings. There is no return to the crushers from this screen. Practically the entire output of crushed stone from this plant is taken by the city of Cincinnati for repairs to street paving.

Unique Sand Washer

The undersize of the scalping screen goes to the sand washer, which is the unique feature of this plant. The material first enters a revolving screen 10 ft. long and 60-in. in diameter. The first section of this is covered with wire cloth with ⅛-in. square openings. The two remaining sections are covered with wire cloth with 5/16-in. square openings. No sprays are used in this screen but it runs about half submerged in a box through which a current of water flows steadily. On account of this part submergence of the screen a sort of cushioning of the screen plates is effected which results in increasing their life to about double that of an ordinary gravel screen. The overflow from this drive carries away dirt and silt. The drive of this sand washer is a 30-hp. Howell motor through a Jones speed reducer.

The sand passing the screen is drawn out of this box by rakes which draw it up an inclined plane. The upper part of this plane is out of water so that the sand is drained before it reaches the overflow lip.

The finest sand is that which goes through the ⅛-in. screen. The remainder is progressively coarser as it passes through the 5/16-in. openings. It has been found that the sizes do not tend to mix by lateral motion as they are drawn up the plane, so the discharge at the overflow lip is graded from fine to coarse. By setting pieces to divide the discharge almost any grading required may be made. At present three grades are regularly made: brick sand (the finest sizes) special plastering sand (the intermediate sizes), and concrete fine aggregate (the coarsest sizes).

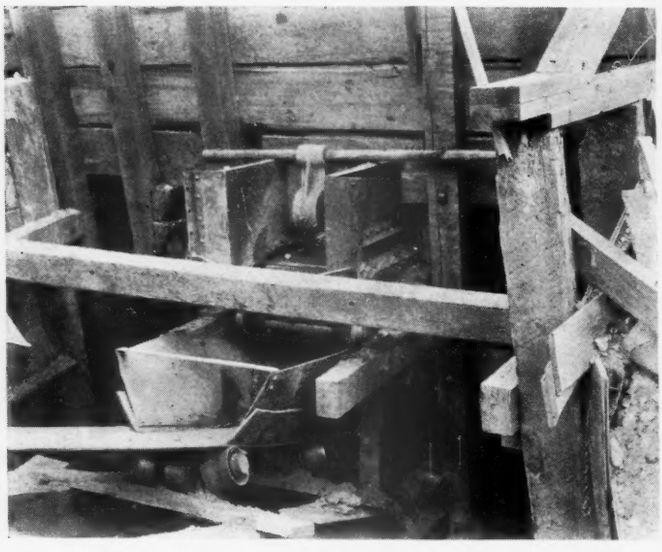
Gravel Preparation

The gravel (all coarser than 5/16-in. and finer than 2½-in.) passes on through a conical screen about 8 ft. long and 4 ft. in diameter at the large end. This is called the "drainage" screen in the plant, because the coarser sizes are drained in it. It has 1-in. round holes. Three sizes can be made, called 1½-in., 1-in. and ¾-in. But a good deal of material in mixed sizes is sold for concrete

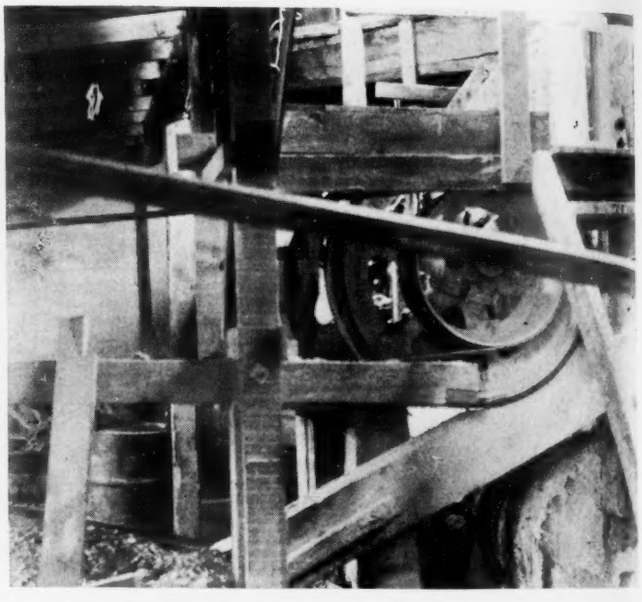
Looking down into the pit showing method of excavating and transporting to plant

Side view of plant showing inclined belt conveyor from the pit—the receiving hopper and grizzly being shown at the extreme right

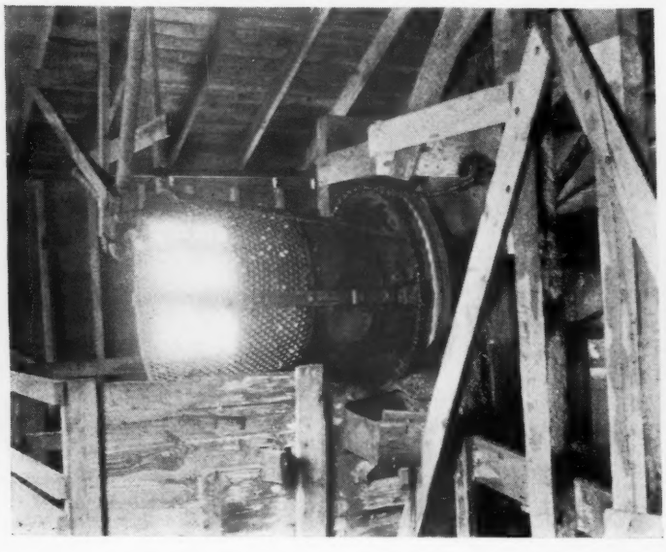
Loading bins—note the unusual height of bins and concrete support

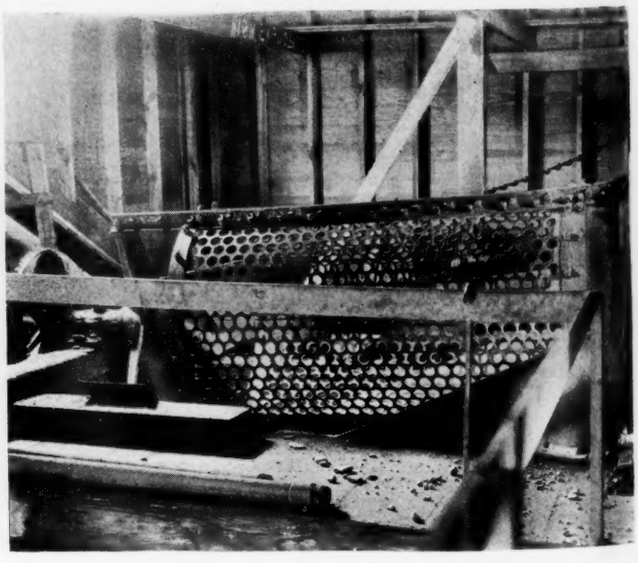


Bank material is fed from the hopper by an apron feeder to the plant conveyor

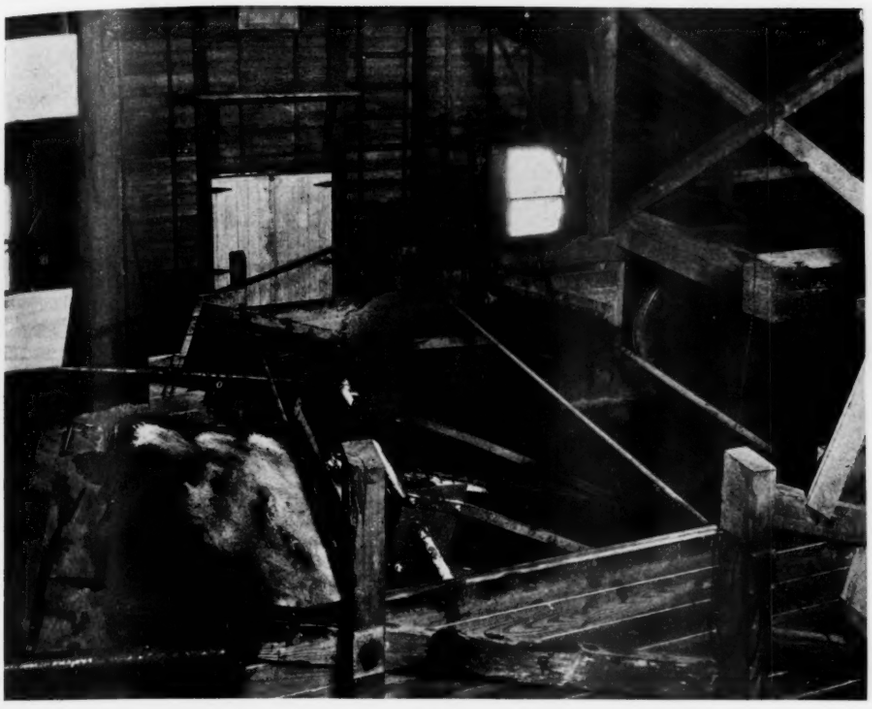


Jaw crusher in the crushing plant for reducing boulders





Bank material is put through the scalper at the right; the undersize passes to the sand screen—the throughs of which then go to the conical gravel screen at the left



The unusual sand washer which is a feature of the plant

aggregate. Special mixtures for reinforced concrete work are also made.

Both gravel and sand are very well washed and of a quality exceptional enough to require a word or two. The gravel pebbles are almost all of very hard rock, quartzite predominating in those which were examined, although some pebbles were of a hard fine-grained granite or syenite. The sand is highly silicious, but much of the coarser grains appear to be of the same material as the pebbles.

Plaster Sand Specially Prepared

This concern is one of the few in the country that has studied plastering sand and tried to make as good a sand especially for plastering as is possible. Its success in that line has been remarkable. Orders come in from long distances, and one order of 1000 tons was recently shipped to Delhi, Ohio, which is 17 miles away by highway. The reason why this sand is so much in favor is that walls plastered with it have been remarkably free from shrinkage cracks and other defects.

However, the company is ready to give plasterers, bricklayers and contractors what they want, and it keeps a regular loose-leaf ledger in which the special requirements of each one of the company's regular customers is entered. Some of these mixes are known by name and some by number, but when one of the "regulars" calls up for a certain kind of sand he is sure to get just what he wants.

Truck Fleet

Delivery is by a fleet of 14 trucks which is made up of nine Macks, one Schact, two Pierce-Arrows and two Libertys. The veteran of the fleet is a Pierce-Arrow truck which has made 75,000 miles in this delivery work and has a lot of work still left in it. All these trucks are painted yellow or orange and have the company's name on the side. Other trucks are hired when business is at the peak and many deliveries are made to contractors who buy at the plant and send their own trucks for it. All material is sold

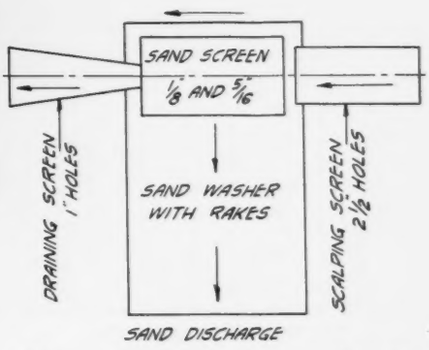
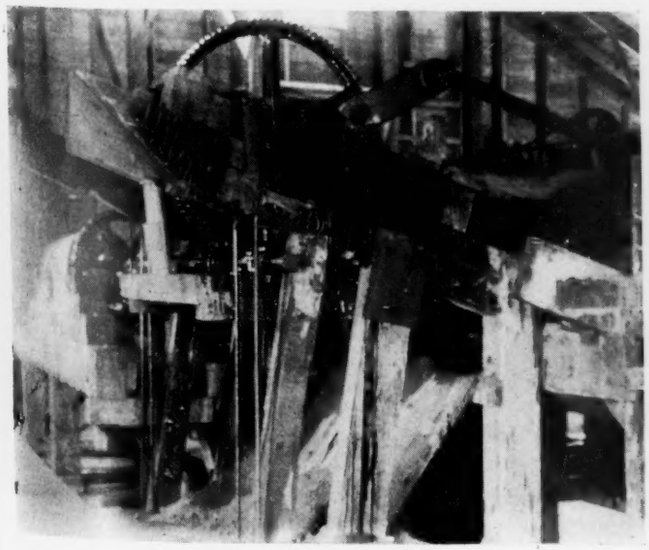


Diagram showing how separations for sand and gravel are made

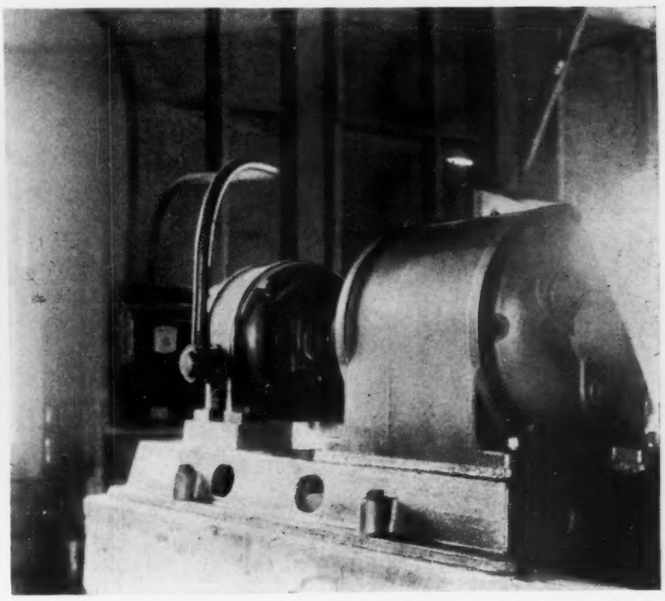
by weight. The company specializes in service making deliveries promptly as received and spacing them according to the contractor's needs where delivery space on the job is restricted.

Dry Sand for Winter Deliveries

Another specialty of this operation is winter delivery. One of the pictures shows the front of the plant closed in for heating, with canvas curtains that may be raised



The sand washer is driven by a 30-hp. electric motor through a speed reducer



Close-up of sand washer motor drive

Two of 14 motor trucks used for making deliveries

Concrete garage building for the truck fleet

when trucks come to be loaded. Advantage has been taken of the fact that the water supply (which is from a well at the side of the plant) has a temperature of 55 deg. F., even in the coldest weather. With the plant heated this water is enough to warm the stone sufficiently to prevent it from freezing. Last winter two street paving jobs and four factory building jobs were kept steadily supplied with material regardless of the weather. A tent was made one day when the thermometer outside stood at 4 deg. above zero F. The gravel in the plant bins had a temperature of 48 deg. F. and arrived on the job at 39 deg. F. One of the features of the plant is a duplicate sand bin in which the material is allowed to drain and dry before it is loaded out.

This is the second sand and gravel plant which the company has built on this site and it was completed in November, 1926. The design and construction is somewhat unusual. The base of the bins is a concrete slab 26-in. thick containing 7 tons of reinforcing steel. The slab is 40 ft. long and 40 ft. wide and on it bins 40 ft. high are erected, the whole being carried on four concrete walls between which are the openings for the trucks to drive into and load. The great height of these bins gives the plant an unusual appearance, and makes an unusual weight on the floor of the bins, but they have been filled a number of times without any sign of settling.

The office of the company is at the plant and the officers are Fred W. Cornuelle, president; George W. Doran, vice-president, and James R. Davidson, secretary. Earl Holwadel is manager in charge of the plant and Joe Wolf is superintendent.

Constructing a Gravel Washing Plant for Truck Service*

By F. W. Cornuelle
Red Bank Gravel Company

FROM a number of years of experience in the gravel business in Cincinnati and the immediate vicinity, both in the building of plants for either rail or truck service, I find the construction of a trucking plant should be somewhat different than a plant built for carload shipments.

In the building of a gravel plant for truck service, there are several very important items in construction to consider that are of major importance for the successful operation of such a plant. Large bins or storage capacity for a truck service plant is of vital importance, and moneys expended for this purpose will lend more to a successful operating plant than any other one item. Deliveries made from a plant of this nature, and the requirements for sand and gravel called for at the plant are irregular, especially so when sales are to retail and wholesale customers, and such a plant must of necessity be built to serve a flexible demand.

In our own operations we have experienced a valuable requirement which mounts from a couple hundred tons one day to over a thousand the following day, causing us quite a bit of anxiety in the maintenance of service. With sufficient storage tipples, requirements of this nature are more easily met. The building of two similar plants with duplicate machinery for each plant has proved to be a very successful method of combating such problems. There is, however, a saving in labor in the building of the larger unit over the operating expense of two plants. A plant built with ample storage affords the operator a chance to serve the trade on peak load days. He may also find time to make a few minor repairs that may arise, provided the plant is backed up with large storage, and still maintain his regular service.

Ample Storage a Factor

The sale of sand and gravel in many instances is a one-day transaction, and the plant with a small bin capacity on such days as the demands are greater than their operating ability, must either refuse business so offered or run short of material some time during that particular day. This act today in the minds of the contractors constitutes an unpardonable sin, and ultimately causes a loss of trade. The building of a washing plant with ample storage capacity enables the plant owner to operate on such days when the demand for gravel is below normal, and also allows for an even distribution of the employes. A plant so designed can operate without interruption on the bad days, when the weather would not permit laborers working out in the open. The yard and track work can then be done when the weather will permit, provided, of course, there is sufficient storage of sand and gravel in the hoppers.

We have found from past experience that for one and possibly two days in each week we will have a sale for sand and gravel greater than the rated operating capacity of our machinery. With a bin capacity large enough we are able to care for such requirement, and are in position to sell our operating output plus what-

*Presented before the Eleventh Annual Convention of the National Sand and Gravel Association, January 19, 1927

ever bin capacity we may have. In other words, large storage is the solution to a more uniform delivery and operation. The question may now arise as to what constitutes the correct size of a trucking plant. My answer would be that a truck service plant should be so designed that the operating capacity should be equal to what may be the peak day demand, and the storage capacity should be equivalent to double the operating capacity.

The water content in sand and gravel when delivered direct from a washing plant is the cause of much complaint and criticism from the consignee. Water dripping from trucks delivering sand and gravel oftentimes leaves the roads leading from a washing plant wet and sometimes unsightly. In some localities laws have been enacted prohibiting the carrying of sand in a wet condition. Sand and gravel delivered on the job wet, causes the contractor quite a bit of inconvenience on account of the condition of the yard storage space. Wherever such material is dumped there is always a loss when same is to be reclaimed.

Excessive Wetness in Sand Not Desirable

The brick and plaster contractors prefer sand delivered in a semi-dry state, so that they can mix the lime or patent mortar with dry sand before adding water. A number of the mason contractors will not receive wet sand at all. Making an allowance for water content for materials delivered in a wet condition is only fairly satisfactory. In the first place the consignee is more or less skeptical and rarely ever does he believe that a certain percentage has been deducted from his invoice for water. In the second place, if the shipper does deduct for water, he is forced to haul a tonnage for which he receives no pay. This will amount to several thousand dollars in a year of fairly good tonnage. There are today several dewatering apparatuses on the market, but none as yet will take wet sand direct from a washer and reduce the water content so that it is entirely satisfactory to the trade.

Duplicate Bins Solve Draining Problems

Although we have used a dewatering machine for several years, we find the best solution for draining sand is in the use of duplicate bins for the same class of material. By this method we are able to serve sand and gravel from bins where the material has been stored at least 12 hours, and sometimes a day, before it becomes necessary to draw it out. This allows the water to drain out and saves the expense of making a large water allowance. While on the subject of water, I might add that the source of water supply is very important when washing gravel in freezing weather. Water taken from a river or small stream when the outside temperature is freezing or below, will be near the freezing point, whereas water taken from a cased-in well will register no less than 50 deg. F. Sand and gravel washed with water at this degree of temperature will pass into the bins at a much higher temperature than gravel washed with river water. Gravel so washed will retain a temperature above freezing in the bins for quite a long time, depending upon the size of the bins, and can be delivered free from frost.

Bin Types

The width of the runs under the tipples of a trucking plant is entitled to some consideration. A runway built too narrow will cause the trucks to bump the sides of the walls and a loss of time in handling; on the other hand, where a driveway is wider than necessary the drivers are inclined to become careless in spotting their trucks for loading, with the result that the equipment is very often loaded to one side. We have found that a driveway about 9½ ft. in width answers the purpose very well. Batch deliveries of sand and gravel today necessitate the building of tipples with more head room. Although the average truck, including the cab, is not much over 8 ft. high, it is necessary to build the floor of the tipple about 14 ft. high to permit the use of batchers.

Washing plants can either be built of wood, concrete or steel, and although concrete is preferable for permanent construction, a bin so designed will hold water longer than a wooden structure and will not drain as readily. Where wood is used the floor of the bins and the side walls for the runways and support of the tipple should be concrete. If this is done the runways at either end can be housed in and the bin gates kept from freezing for winter operation by the use of salamanders.

The type of wooden bin construction commonly used is built by standing a certain size of studding upright, nailing the sheathing to the inside, and girdles belted around the outside and tied together with rods running to either side of the tipple. This makes a very rigid tipple, but, on account of the horizontal position of the sheathing boards and the numerous angles for water, it will rot in a short time, and it is also difficult to repair.

The silo type of wood construction, although it is a somewhat more difficult task to build, makes a more permanent tipple. It will not rot nearly so quickly, takes less lumber in building, and saves several square feet of floor space of the outer area of the building. A tipple should be built square or nearly so wherever it is possible, and is preferable to the oblong type of construction. There is a saving in the amount of material used, it allows for more than one runway under the tipples, and also provides better floor space on the top floors to place the machinery.

Plant personnel of the Red Bank Gravel Co.—Fred Cornuelle at the right

Simple Machinery an Essential

The machinery in any washing plant should be simple, with as few chutes as possible to do the work required. Ample floor space around each screen is very necessary. Cramped placing of material is oftentimes the cause of insufficient oiling. It also retards making repairs when screens are placed too close to each other. Where electric power is available, an individual motor for each unit is advisable. The motor should be larger than the rated horsepower of the machine to be driven, to insure steady power with few breakdowns. In a plant we just recently completed we installed a separate motor for each machine. The motors operate through speed reducers. Thus we are able to eliminate all belt, spur-gears and chain drives. The speed reducers were placed on trial and proved to be a success.

On account of the oversize gravel in many deposits, the installation of crushers is essential. There is a difference of opinion as to the location of the crushers relative to the balance of the screening machinery. In some plants the crushers are placed up in the building, while in others they are placed on the ground level. When placed in the plant so that the oversize may be fed direct to the crusher from the grizzly screen, there is a saving in re-elevating the crushed produce, but the stone is generally wet and more difficult to screen. The crushers take up valuable space in the plant, and it is impossible to provide storage space for the uncrushed oversize in case of breakdown to the crushers. Placing crushers on the ground floor allows room for the uncrushed oversize.

Reclamation of Worked-Out City Gravel Pits a Problem

ANYONE who has visited Los Angeles, Calif., and noted the abundance of "holes in the ground," from which sand and gravel have been taken, or are being taken, must wonder what will happen as the city grows up around these holes. Hence the following contribution from a California newspaper is of interest.

"A solution of the problem of reclaiming valley lands now being mined for sand and gravel is announced by James Gautier, president of the Consumers Rock and Gravel Co. According to Mr. Gautier the pits will be filled with surplus dirt hauled in from big development projects which will be under way for the next five years. Many propositions have been made, he declares, to use the land for dumping grounds, but the gravel concerns have entered into an agreement with property owners not to permit the ground to be used for this purpose, so all such propositions have been declined.

"While the pits are being filled with dirt, the lands will be mined by the companies until all the resources have been utilized, states Mr. Gautier. The Consumers Rock and Gravel Co. now has five plants operating in the valley, it is pointed out, and employs over 1000 men.

"The large pits left by the various companies have resulted in the Los Angeles city council taking drastic action against the location of new plants."

Talk of Gravel Conservation in Minnesota

THE following newspaper article, whatever its inspiration, is interesting in showing a layman's concern for the future of gravel resources. Most well-informed sand and gravel producers realize that the available and accessible sources of good commercial sand and gravel are by no means inexhaustible, common as is this material. Several localities are already beginning to feel the exhaustion of such deposits. This item is taken from the *Keewatin* (Minn.) *Chronicle* and reads as follows:

"Is there danger of a gravel shortage in Minnesota?

"Such a fear may never have occurred to people who are accustomed to think of Minnesota as having unlimited gravel beds, but the continued use of large quantities on the trunk highways suggests the danger that the available gravel in some counties may be used up so that before long the towns and counties may not have the needed supplies conveniently at hand.

"Standard trunk highway gravel surfacing calls for about 1400 cu. yd. per mile. With traffic around 500 cars per day, this may last ten years; with traffic of 1000 cars per day it is expected to last about five years; while on some of the heavily traveled roads, so-called 'heavy gravel' surfacing is worn out in less than three years. This is based upon the experience of the last six years, which have been comparatively dry, and a series of wet years may cause gravel to disappear much more rapidly.

"According to the state and the United States Geological Survey, the supply of gravel in Minnesota is unlimited. But it is not always conveniently available. It is not evenly distributed. Some counties have very little, and in many other places the big gravel beds are deep below the surface.

"Naturally, the beds near the surface are taken first. A gravel bed 10 or 15 ft. below the surface may be easily accessible to a railroad or a road contractor with large equipment, but it could not be economically handled by a smaller unit using lighter equipment.

"The abundance of gravel in Minnesota was a big factor in bringing the main roads out of the mud. Recent figures from the Bureau of Public Roads showed that the state has nearly 25,000 miles of road surfaced, including its trunk highways, state-aid, county and town roads, or nearly one-fourth of its entire road mileage. Only four states, New York, Indiana, Ohio and Wisconsin, have a larger total mileage surfaced.

"This leaves 75,000 miles of roads, mostly town and county roads, unsurfaced. While the number of cubic yards of gravel needed per mile is much less than on the main highways, it would seem that some thought should be given to the subject of gravel conservation.

"Where gravel is available without too long a haul, it is the most economical surfacing for any road carrying less than 500 vehicles per day. But the Minnesota trunk highway system has about 1000 miles of unpaved road carrying more than 1000 vehicles per day, some of them considerably more than 2000 per day. Under such traffic gravel is ground into powder very rapidly, blown away in dry seasons and washed away when it rains. This emphasizes the statement frequently made by State Highway Commissioner C. M. Babcock, that it would be economy to pave many of the heavily traveled routes. The rapid use of the most available gravel will gradually increase the cost of gravel surfacing both on trunk highways and on local roads."

Wages Raised 5.2% in 26 Industries

ACCORDING to the monthly economic news letter of the Labor Bureau, Inc., "sixty-four wage increases and sixteen decreases were reported during February. Half of the cuts were in textile mills and more than half the gains were recorded by the printing trades. Advances of from 2c to 3c an hour were awarded railroad workers—dispatchers, conductors, trainmen and some of the shop crafts. According to the United States Department of Labor, wage rate increases in twenty-six industries reported for the month ended January 15 averaged a 5.2% gain and affected 4787 employes. Decreases in seven industries—cotton goods, hosiery, and knit goods, lumber sawmills, furniture, fertilizers, brick and automobile tires—averaged about 5.5% and affected 2214 workers.

"The decrease in industrial activity and consequent lowered volume of employment and earnings have not left the workers any worse off than they were before the recent slackening. Retail food prices and the published cost of living figures have shown moderate declines, so that real wages are about where they were. Decreased earnings mean decreased purchasing power, but as prices have eased off correspondingly the standard of living of those employed has not been perceptibly impaired. If prices were to take a sudden upward turn industrial workers would feel a sharp pinch in their pockets at the end of the week. Rents remain high and satisfactory homes are not easy to find. This one factor remains the biggest problem and the one hardest to solve for workers in or near the large industrial centers."

Concrete Aggregates, Report of Committee E-5 of the American Concrete Institute

Extracts of Report Supplementing Convention Report in Rock Products, March 5, Pages 49 and 50

THE brief report of the American Concrete Institute meeting at Chicago, February 22-24, published in ROCK PRODUCTS, March 5, pp. 49-53, stated that "the report of the aggregate committee was confined to gravel requirements and was prepared by the sub-committee of which Stanton Walker is chairman." This statement was not correct, nor was it fair to A. T. Goldbeck, chairman of the subcommittee on crushed stone, and H. J. Love, chairman of the subcommittee on slag. It should have read that the part of the report abstracted in that issue was confined to requirements for gravel aggregates. Space in that particular issue prevented going into more detail, so we give below extracts from the reports of all three subcommittees, omitting some of the material on gravel, already published.

Gravel Aggregates

Exhaustive researches in concrete aggregates have been carried out during the past 10 to 15 years in different laboratories. Most of these studies, however, have been confined to the effect of variations in grading and proportioning of aggregates on the strength and density of concrete; comparatively little has been done which gives conclusive information on what constitutes minimum requirements so far as quality of particles is concerned. These tests have shown that the strength and other properties of concrete are dependent to a large extent on the relative quantities of cement and water in the mix, so long as the aggregate is structurally sound, durable and clean. The grading of the aggregate, particularly its uniformity of grading, is, however, important from the viewpoint of economy and of the uniformity in quality of the resulting concrete.

Most of our present-day specifications for concrete aggregate are "rule of thumb" documents based on engineering judgment of local conditions. It is essential, of course, that the specification of requirements for gravel, as for any natural material, take into consideration the characteristics of deposits in the different localities; this is particularly true of grading. However, certain fundamental requirements are applicable to all localities and should be dictated by the nature of the service to which the materials will be subjected. Practical considerations demand that aggregates have such physical characteristics that definite proportions may be specified with the assurance that concrete of the required quality will be obtained. From this point of view it is essential that suitable requirements as to hardness and strength, durability, cleanness and grading, particularly uniformity of grading, be stated. The statement of requirements for quality of aggregate particles is complicated by the lack of significance of the chemical composition of the aggregate, and must depend entirely on physical characteristics. The usual specification attempts to do this by specifying that the gravel shall consist of particles which are "hard, strong, durable, uncoated, and free from injurious amounts of soft, friable, thin, elongated, or laminated pieces, alkali, organic, or other deleterious matter." In addition to this formidable catalogue, a requirement for grading is invariably included.

Lack of information concerning the effect of many of these characteristics has made it impossible to place proper limitations on all of the different factors involved. Grading is the only factor of which it may be said that anything approximating adequate information has been obtained; only the most limited data are available on what constitutes proper limitations for characteristics, such as hardness, strength, durability, etc. The principal part of this report is devoted to discussions of the physical characteristics of the aggregate particles.

Hardness and Strength of Gravel

What constitutes sufficient hardness and strength in gravel for concrete for different purposes? Probably, but not positively, the service to which the concrete is to be subjected, whether to resist compressive and tensile stresses, abrasion, impact, weather, etc., has an important bearing on what the requirements for these factors should be. The studies of this subcommittee indicate a woeful lack of information on the question—entirely insufficient to enable it to make definite recommendations for specification limits.

A number of researches have been carried out by different laboratories in attempts to establish relationships between some measure of the hardness and strength of gravel and its concrete-making properties. Most of these studies have looked toward the development of some modification of the American Society for Testing Materials standard Deval abrasion test for crushed stone. An impact test for gravel,[1] in which individual particles are subjected to a blow from a falling steel ball, has been studied by the Bureau of Public Roads, the New Hampshire State Highway Department, and by others. A pressure test on individual gravel particles, made with an instrument known as the Douglas machine, has been studied by the Iowa State Highway Commission. Abrams, at the Structural Materials Research Laboratory (now Research Laboratories of the Portland Cement Association), made studies of a crushing test,[1] in which a confined sample of graded gravel was loaded in a testing machine and the effect measured by the differences in sieve analyses made before and after the test.

The modification of the Deval abrasion test, to which most attention has been given, is that originally proposed by M. A. Rea, of the Ohio State Highway Department, and described in United States Department of Agriculture Bulletin No. 1216. This method consists of testing a graded sample of gravel in the standard Deval cylinder, with cast iron shot included in the same as an abrasive. State highway departments, feeling the need of a tangible measure of the hardness and strength of gravel particles, have in many cases specified a limiting percentage of wear, as measured by this method. In general, the limitation is placed at 15%, although in a few cases as low as 10% and as high as 25% is specified.

This test, or some modification of it, seems to offer possibilities for measuring the hardness of gravel and for comparing its hardness with that of crushed stone, measured by the standard Deval abrasion test. However, data obtained up to this time have not established a definite relationship, nor, so far as we have been able to learn, do they indicate any dependence of the concrete-making properties of gravel on its hardness as measured by this test. It should be pointed out that the results of any modification of the Deval test depend greatly on the size and shape of the particle, and that the method suggested by the highway officials does not permit of making the test on gravels which do not contain the coarser sizes of particles.

The impact test proposed by Jackson[2] is not properly, nor is it claimed by Mr. Jackson to be, a method for measuring the hardness of gravel as a whole. It seems, however, that it may provide a basis for the elimination of gravels with too high a percentage of soft and friable particles. However, sufficient information has not been obtained on this test to draw definite conclusions concerning its practicability. The method is, fundamentally, only a refinement of the "rule of thumb" test of striking particles of gravel with a hammer and observing their hardness. Mr. Jackson states that, as a result of his more recent studies of this method, he has come to the conclusion that the procedure outlined in his paper is somewhat too severe, and he plans to make a number of changes in the details of the test method.

The pressure test with the Douglas machine, used by the Iowa State Highway Commission, is for the purpose of determining the percentage of "rotten stone" in a sample of the gravel. A 1000-gm. sample is subjected to a visual examination and the particles classified as hard, soft or partially disintegrated (rotten stone). In case of doubt as to whether a particle should be

[1] See 1922 *Proc.* Am. Soc. for Testing Mat., Part II, "An Impact Test for Gravel," by F. H. Jackson, with discussions by W. F. Purrington and Duff A. Abrams.

[2] See 1922 *Proc.* Am. Soc. for Testing Mat., Part II.

classified as soft or partially disintegrated, it is subjected to a steady pressure in the machine, as follows:

Particles retained on 0.742-in. sieve.... 75 lb.
Particles passing 0.742-in. sieve and retained on 0.371-in. sieve..... 60 lb.
Particles passing 0.371-in. sieve..... 35 lb.

Mr. Crum states that this method of test has been found to be very satisfactory.

The crushing test described by Abrams seems to offer promise as a method of measuring the strength of gravel particles, although studies to date have not indicated any relation between this test and the concrete-making properties of gravel. It was adapted from a method used in Austria.[3]

The time available for the preparation of this report did not permit of anything approximating a detailed survey of the existing information on this question. Studies have been made of typical data, which are probably as comprehensive as any, from Jackson and Pauls' paper on "Accelerated Wear Tests on Concrete Pavements"[4] and from unpublished data (Series 135) of the Structural Materials Research Laboratory.

These investigations included tests of a wide variety of gravels and other aggregates. Compression, transverse, and abrasion tests of concrete and results of various modifications of the Deval abrasion test, specific gravity, absorption, and crushing test of the aggregates were made. A summary of the data of the tests with gravel is given in Appendices 1 and 2 of this report.

It seems obvious that these data do not provide sufficient information to serve as a basis for fixing limitations on the different characteristics measured. The conclusion which seemed to be logical from a study of them is that, within the range of these aggregates and for the conditions of these tests, no well-defined relation exists between the results of the Deval abrasion test, the crushing test, specific gravity, absorption, or unit weight, and the concrete-making properties of a gravel as measured by the compressive strength, transverse strength, or resistance to abrasion in the Talbot-Jones rattler test. As stated above, the gravels tested represented a wide range in quality and were from widely separated localities.

In view of the lack of definite information showing any dependence of concrete-making properties of a gravel on its hardness and strength, as measured by any of the methods studied, this subcommittee does not feel that it is in a position to offer definite recommendations for specifying hardness and strength of gravel which could be considered as on a sound basis of knowledge or as an improvement over existing specifications.

It does not seem unreasonable to suppose that, *except for soft, friable, and partially desintegrated particles and particles which are not durable on exposure to the weather,* any material which has withstood the action of the elements necessary for the formation of gravel, consists of particles hard enough for the usual service in concrete. We feel, however, that a more complete study of existing information and further comprehensive investigations are needed, definitely directed toward a solution of this problem.

Durability of Gravel

Considerable work has been done in an attempt to develop a test which may be used to determine whether or not an aggregate will be durable in concrete. The method of test for soundness of aggregate which has received most attention is that recommended by the American Association of State Highway Officials and described in United States Department of Agriculture Bulletin No. 1216. This test consists of alternately soaking a sample of the aggregate in a saturated solution of sodium sulphate (Na_2SO_4) for 20 hours and drying it in an oven for 4 hours. This operation is repeated five times. This test seems to have been developed by M. Brard in connection with studies of the resistance of building stone to frost action. The test has been used by various investigators in studies of building stones, clay products, concrete, and mortar. Studies of this method of test are being carried out at the U. S. Bureau of Public Roads, U. S. Bureau of Standards, Allegheny County Highway Laboratory, research laboratories of the Portland Cement Association, Minnesota State Highway Department, and others. Most of the work, however, has been on crushed stone; only a few studies have been made on gravel. The general conclusions thus far seem to be that this test method is not a necessarily true indication of the durability of an aggregate in concrete! many aggregates which fail in this test apparently give satisfactory results in concrete.

Shale is the most common material, which sometimes occurs in gravel deposits, known to be unsound in concrete. Its occurrence, however, is not general and is limited to a comparatively few localities. Comprehensive studies of the effect of shale in Minnecota gravels have been carried out by F. C. Lang of the Minnesota States Highway Department. They show that even small percentages of shale cause considerable reductions in compressive strength.

Mr. Lang points out that quantities of shale less than will produce a harmful effect on the compressive strength should not be permitted in gravel, particularly for wearing surfaces, as he feels that the shale will invariably be worked to the surface and form spots which will disintegrate at an early period under the action of the weather and traffic. He points out that their experience has caused them to limit the amount of shale permissible in gravel for concrete highway construction to 0.5% by weight.

Most of the state highway departments place only the time-honored "free from" limitation on shale and similar materials, although Kansas, Iowa and Minnesota specify a maximum of 0.5% shale, while Kentucky places a limitation of 1% on shale, slate, etc., and Michigan 3% on shale and other non-durable particles.

Soft, friable, laminated, and light-weight particles should be taken into account in the consideration of durability of gravels, as well as those particles which are not durable on exposure to the weather. Probably no one test can be devised which will take into account these different factors.

Further studies of accelerated freezing and thawing tests, such as the ones using sodium sulphate or sodium chloride, will undoubtedly result in the development of a method for judging of the resistance of gravel particles to the action of the weather.

This subcommittee believes that any soundness test for gravel should be used to determine the percentage of unsound particles, and that limitations should be stated on this basis rather than to specify that no particles shall exhibit evidence of unsoundness.

Soft, friable, and laminated particles would, undoubtedly, in many cases be attacked by a soundness test. As an additional precaution it is suggested that an impact test along the lines described by Jackson, or a pressure test similar to that used by the Iowa State Highway Commission, can be adapted to the limitation of such particles.

In view of the fact that the most important objection claimed for relatively small quantities of soft and non-durable particles is that, due to their light weight, they are floated to the top and thus form a wearing surface in which pits will occur, this subcommittee suggests a limitation of the amount of such particles on the basis of their specific gravity. A specific gravity of about 2.0 (apparent) is suggested as a practical dividing line, since it will be generally recognized that practically all gravel will have a specific gravity well above this value (2.4 probably the low limit in the vast majority of cases), and that the definitely objectionable particles, which will be floated to the surface of concrete, will generally have a specific gravity lower than 2.0 (about 1.6 in the case of shale). The use of a liquid of high specific gravity, such as zinc chloride ($ZnCl_2$), has been tried with success. A method of making the test, with particular reference to shale, is suggested in U. S. Department of Agriculture Bulletin No. 1216. Tests have also been carried out in which lead acetate was the liquid.

This subcommittee suggests that recommendations for durability of gravel should be for the purpose of eliminating particles of low specific gravity which will have a tendency to be floated to the surface and particles which will disintegrate in the weather.

Judgment of the durability of a gravel might, therefore, be based on:

(1) The percentage of particles which will not withstand the action of the weather, as measured by a suitable accelerated freezing and thawing test.

(2) The percentage of soft, friable, and laminated particles which would withstand a suitable impact test or pressure test.

(3) The percentage of light-weight particles which would be floated by a liquid of suitable specific gravity—gravity about 2.0.

It is recognized that there probably would be much overlapping of these three tests; that is, particles eliminated by one of them would also be eliminated by one or both of the others. It is hoped that further work of this subcommittee will result in the development of a suitable procedure for these tests.

Cleanness of Gravel

The usual requirements for clean gravel is that it be free from injurious amounts of coated particles, clay and silt, loam, alkali, and other deleterious substances. In general, no comprehensive investigations have been carried out for the purpose of making a quantitative determination of the effect of these various factors.

The effect of coatings on gravel will obviously vary with the nature and use of the concrete, and is difficult of determination in the laboratory.

Clay or silt, provided it is free from organic matter, or other deleterious material, will not react chemically with the cement and may be present in considerable quantities without producing an appreciable effect on the strength of concrete. Nevertheless, clay and silt may be objectionable from a number of considerations. In concrete highway construction it is felt that the presence of clay in the aggregate plays an important

[3] See *Proc.* Int. Assn. Testing Mats. (1912), 2d Section, Paper XXVI.
[4] See 1924 *Proc.* Am. Soc. for Testing Mat., Part II, and *Public Roads,* Vol. 5, No. 3, May, 1924.

part in the production of surface scaling. In reinforced concrete work, where fairly wet mixtures are used, clay is apt to be worked to the surface and form laitance, thus causing a weak section, particularly at the joining of two days' work. This is particularly objectionable on exposed surfaces. It is obviously from this that a definite measurement of the effect of the various quantities of clay and silt is not easy. Highway engineers have probably given more intelligent consideration to the effect of finely divided particles in concrete aggregates than others, but, in general, they have limited their consideration of them to the fine aggregates. It is common practice to limit the amount of material removed by decantation from sand to 3%, although a number of state highway departments make their limitations as rigid as 2%. If over 3% of finely divided material is objectionable in sand, it would seem that a smaller quantity than 3% would be objectionable in gravel. However, the effect of inert, finely divided particles, such as clay and silt, depends to a great extent on the use to which the concrete is to be put, and this committee feels that it does not have sufficient information to justify it in suggesting limitations for all uses. Comprehensive studies of the effects of finely divided materials on the strength of concrete are given in Bulletin 8 of the Structural Materials Research Laboratory, "Effect of Hydrated Lime and Other Powdered Admixtures in Concrete," by Duff A. Abrams. However, we feel that tests should be carried out to determine the effects of various amounts of finely divided material, not only on the strength, but particularly on the surface condition of the concrete.

Other deleterious materials, such as loam, organic matter, alkali, etc., should be limited, based on the effect of individual substances on the quality of the resulting concrete.

The quantity of loam and organic matter should be limited by their effect on the strength of the concrete. While it is recognized that, generally, gravels are not apt to contain sufficient organic matter to be harmful to concrete, it would seem desirable to guard against the unusual case by placing a limitation based on the Abrams-Harder Colorimetric Test, adopted as standard for the American Society for Testing Materials. It is suggested that this test should be carried out on material finer than No. 4 mesh sieve and the results calculated in terms of the total aggregate.

The presence of alkalis in gravel is not common. In general, tests have shown them to have little effect on the strength of the concrete for the quantities in which they are apt to be found. They would be objectionable in certain classes of concrete work, in the effect which they would have in producing efflorescence on the surface. Data on the effect of sulphate waters, sodium chloride, and various industrial wastes in concrete are given in Bulletin 12 of the Structural Materials Research Laboratory, "Test of Impure Water for Mixing Concrete," by Duff A. Abrams.

Other "deleterious substances" is at best a somewhat indefinite classification, and it is urged that work be carried out to determine what these substances are. Materials such as coal, lignite, mica, pyrite, oils, etc., should be considered.

Grading of Gravel

Considerable information is available on the effect of grading of aggregate, and specifications for grading can be written with a fair degree of knowledge of the effect on the resulting concrete. Such specifications should emphasize uniformity of grading and must take into account not only the most desirable grading from the viewpoint of the quality of concrete, but also economy as governed by local conditions. For example, the specification of ¼ to 2½-in. gravel as the only size suitable for highway construction would not be economical, when it is considered that in many localities a material meeting this specification could not be produced. A specification for grading of gravel must, therefore, be based on the premise of securing materials which will give the desired results consistent with the greatest economy. Different gradings can be used to obtain concrete of the same quality by making proper variations in the proportions. Too much emphasis, perhaps, has been placed on the specification of a definite grading and on the use of the coarser sized particles without giving proper consideration to the most economical grading.

This subcommittee feels that it is not within its province to specify sizes of gravel for different uses, but that these should be determined by local conditions. Specifications for grading should also be predicated on a study of the material in different localities. We recommend the following form of specification as tending to promote uniformity of grading:

RECOMMENDED GRADING SPECIFICATIONS

Passing (maxium size) inch sieve	95 to 100%	Spread not more than 35%
Passing (½ maximum size) inch sieve	— to —	
Passing No. 4 sieve	0 to 10%	

It will be recognized that each specification for grading will require separate consideration of the proportions which should be used to produce concrete of the quality desired.

Resistance to High Temperatures

The mineralogic composition of the aggregate undoubtedly has an important bearing on the resistance of concrete to high temper- that the efficiency of an aggregate in fireproof construction is not necessarily directly proportional to its resistance to high temperatures in the laboratory. The fire hazard, atures. It is generally recognized, however, ability of the material to resist the spread of fire, the frequency with which high temperatures occur, and the period of exposure, should be taken into consideration in determining upon the suitability of an aggregate for fireproof construction. The question is not discussed in this report, as Committee E-4 of the American Concrete Institute has in charge studies of the "Fire Resistance of Concrete" and has published the results of their findings in the 1925 *Proceedings* of the American Concrete Institute.

Recommended Studies

More complete studies and further comprehensive researches are required, definitely directed toward the determination of the relation of the physical characteristics of gravel to its concrete-making properties. It is suggested that particular emphasis should be placed on studies of lean mixtures tested at advanced ages, since in such concrete the quality of the aggregate will be of most importance.

Further studies of hardness and strength of gravel particles should be made, and it is suggested that modifications of the Standard Deval Test and the crushing test are worthy of further attention. In studies of such tests, careful attention should be given to the effect of the grading of the aggregate.

In selecting the sizes of materials for a standard test, the wide range in sizes of gravel should be kept in mind. For example, a test which requires the use of 1½-2-in. particles would not be applicable in certain localities when the largest particles of gravel available may be under 1½ in.

Since the minimum degree of hardness which a crushed stone should have to give good service in concrete pavements seems to be fairly definitely fixed, it would seem desirable to determine the relationship between the Standard Deval Abrasion Test on crushed stone and some modification of the Deval Test for gravel. This might be done by using crushed stone for both tests, making the standard test on the crushed material and the modified test on the same material for which the particles had been rounded in a ball mill. Work of this nature is now under way at the Bureau of Public Roads. Information might also be obtained by making the standard test on crushed gravel and the modified test on rounded particles from the same deposit.

More conclusive information is required in order to make definite determinations of the soundness and durability of gravel. Studies of the accelerated freezing and thawing test should be continued. The impact and pressure tests mentioned above seem to offer promise as a method for determining the amount of soft and friable particles, and further studies should be made of this method. The determination of light-weight particles by flotation on a liquid of high specific gravity seems to be a worthy subject for further researches.

The effect of finely divided material in gravel, such as clay, silt, loam, etc., should be studied with particular attention to the surface condition of the concrete made from it.

More definite information concerning the occurrence and effect of alkali in gravel is needed before consideration can be given to placing definite limitations on it.

(The subcommittee's recommendations for a specification for gravel were published on page 50 of the March 5 issue of Rock Products.)

Tests of Effect of Shale

Tests were carried out to determine the effect of different percentage of shale in gravel on the compressive strength of concrete cured under freezing and thawing conditions and under normal temperatures, with the view of obtaining information on which to base specifications for the amount of shale permissible in gravel used for concrete construction.

Well graded sand and gravel were used as the aggregate; the gravel was from the John Wunder Co., Minneapolis, and the sand was from the J. L. Shiely Co., St. Paul. The shale, from the Minnesota Pipe and Tile Co., Appleton, Wis., was added to the gravel with the proportions of different sizes the same as in the gravel.

Compression tests of 6x12-in. concrete cylinders of a 1:2:4 mix were made at the age of 28 days. Three specimens were made and tested for each condition. Four different series of tests were made.

Following are the conclusions which Mr. Lang draws from these tests:

(1) Results of the foregoing tests show

that the presence of shale even in small quantities is very detrimental to the strength of concrete, especially when the concrete is used in structures where it will be subjected to an alternate freezing and thawing action.

(2) Strength of concrete containing shale varies inversely with the percentage of shale the coarse aggregate contains.

(3) The effect of weathering on shale is shown in the decreased strengths where test specimens were subjected to freezing and thawing. When the coarse aggregate contained more than 60% shale the strength was very low and the freezing and thawing did not appear to further weaken it.

(4) Concrete in which the coarse aggregate was 100% shale showed a compressive strength in 28 days equal to about 40% of the strength of concrete which contained no shale. It is probable that eventually such concrete would entirely disintegrate.

(5) In these tests care was taken to see that there was no separation of the shale due to its lighter weight. This care could not be taken in ordinary construction, especially pavements.

Characteristics of Crushed Stone Coarse Aggregate

The intent of this report is to present information on the characteristics of crushed stone coarse aggregate and, so far as possible, the effects of those characteristics on the properties of concrete.

The subject matter is discussed under the following headings:

(1) Classification of rocks.

(2) General discussion of rock characteristics.

(3) Physical tests of rocks.

(4) Properties of crushed stone for concrete for various uses:

(a) Unexposed concrete subjected to static and impact stresses.

(b) Concrete exposed to the weather.

(c) Concrete highways—surface abrasion.

(d) Concrete exposed to chemical action.

(e) Concrete for water resistance.

(f) Concrete for fire resistance.

Classification of Rocks

The following classification of rocks has been proposed by Dr. E. C. E. Lord of the U. S. Bureau of Public Roads (Department of Agriculture, Office of Public Roads Bulletin 31, "Examination and Classification of Rocks for Road Building") and will serve to classify rocks used as aggregates:

TABLE I. GENERAL CLASSIFICATION OF ROCKS

Class	Type	Family
I. Igneous	1. Intrusive (plutonic)	a. Granite
		b. Syenite
		c. Diorite
		d. Cabbro
		e. Periodotite
	2. Extrusive (volcanic)	a. Rhyolite
		b. Trachyte
		c. Andesite
		d. Basalt & diabase
II. Sedimentary	1. Calcareous	a. Limestone
		b. Dolomite
	2. Siliceous	a. Shale
		b. Sandstone
		c. Chert (flint)
III. Metamorphic	1. Foliated	a. Gneiss
		b. Schist
		c. Amphibolite
	2. Nonfoliated	a. Slate
		b. Quartzite
		c. Eclogite
		d. Marble

The *igneous* rocks are supposd to have been formed by solidification from a molten state either at the earth's surface or at some distance below. These solidified at the surface, the extrusive, igneous rocks, have cooled quickly, are rather fine-grained, glossy and vesicular or have a porphyritic structure having large crystals in a fine-grained ground mass. The intrusive or deep-seated igneous rocks have been solidified slowly and under great pressure. They are generally coarsely crystalline with their constituent minerals well defined as contrasted with the fine-grained extrusive rocks. The term "trap" from the Swedish word "trappa" (meaning "stair") is commonly applied to the dark-colored igneous rocks such as gabbro, peridotite, diabase, basalt and others.

The *sedimentary* rocks are made up through the consolidation either of the products of former rock disintegration, as in the case of sandstone, shale, conglomerate, etc., or from the accumulation of organic remains of a calcareous nature forming limestone or dolomite. Sometimes these materials have been mechanically deposited; at others, chemically precipitated, as in the case of flint, chert, travertine limestones, etc.

Metamorphic rocks have been produced by the prolonged effect of chemical and physical agencies such as pressure, heat, moisture, etc., on both igneous and sedimentary rocks. Thus gneiss and schist are metamorphosed igneous rocks, while quartzite, marble and slate have resulted from an alteration of the sedimentary rocks. Some of the metamorphic rocks such as slate and schist, because of their shape after crushing or due to their structure, are not as highly regarded for use in concrete as the igneous and most of the sedimentary rocks.

Obviously the physical properties of rocks are influenced by the characteristics of the component minerals and by the structure of the rock. A thorough understanding of the resistance of any rock must therefore involve a knowledge of the mineralogical composition of that rock and of the properties of the individual minerals. There is some question, however, as to the degree of decomposition any rock will suffer after it is incorporated into concrete as a coarse aggregate, for evidently the mortar offers some protection to the embedded rock.

Physical Tests of Rocks

The physical tests of rocks have been developed, for the most part, in connection with their road-building properties, but none the less the tests are in general aimed at the determination of fundamental properties, and thus the physical qualities determined by tests give a very fair idea of the degree of resistance of the rock. The tests most commonly employed are the Deval abrasion test in which the results are expressed as percentage of wear or French coefficient of wear $\left(= \frac{40}{\text{per cent wear}}\right)$, the toughness test, the Dorry hardness test, the test for crushing strength, and the absorption test. These tests have been described in the U. S. Department of Agriculture Bulletin 347.

The results of tests made on thousands of samples of rock show that rocks of all classes range considerably in their physical characteristics. (See U. S. Department of Agriculture Bulletin 370.)

Average results are not of any great value in view of the wide variation from the average to be expected from any particular sample of rock contemplated for a given use, and it thus becomes important to discuss the properties of rock for use as an aggregate from the standpoint of the service it is expected to render. Before leaving the subject of test results, however, the resistance of a rock to freezing and thawing or to some form of accelerated soundness test should be mentioned, as such tests throw considerable light on the suitability of a rock for use as a concrete aggregate, though much remains to be done in formulating proper methods for making these tests and in establishing safe test limits.

Classes of Service to Be Rendered by Concrete and the Influence of the Coarse Aggregate

It is obvious that before any consideration can be given to the properties necessary for coarse aggregate it will be necessary to study the various kinds of service which concrete is called upon to render. This subject has already been treated (American Concrete Institute *Proceedings*, 1926, "What Are the Most Significant Tests for Concrete?" by A. T. Goldbeck). It was pointed out that different structures have to withstand different combinations of stresses and that, depending upon conditions of service, concrete is called upon to be resistant along the following lines:

1. Compression.
2. Tension.
3. Cross-bending.
4. Shear.
5. Impact.
6. Surface abrasion.
7. Chemical action.
8. Freezing.
9. Stresses from alternate wetting and drying.
10. Absorption.
11. Permeability.
12. Heat resistance.

The Properties of Crushed Stone for Concrete to Withstand the Above Actions

To arrive at the characteristics of stone suitable for concrete it seems entirely proper to consider these characteristics in the light of the service the concrete must render, and the above twelve listed forms of resistance include practically all of the conditions to be met in service.

For the purpose of studying the effect of the coarse aggregate on the resistance of the concrete the above individual forms of resistance may be grouped as follows:

(a) Unexposed concrete subjected to static or impact stress.

(b) Concrete exposed to the weather.

(c) Concrete highways—surface abrasion.

(d) Concrete exposed to chemical action.

(e) Concrete for water resistance.

(f) Concrete for fire resistance.

(a) *Unexposed Concrete Subjected to Static or Impact Stress—*

1. Compression.
2. Tension.
3. Cross-bending.
4. Shear.

It is very seldom the case that the crushing strength of stone proposed for use as aggregate is less than that of the strongest concrete made. It would seem logical that so long as the stone has a crushing strength at least equal to that desired of the concrete, the strength of the stone will not be a factor in influencing the strength of the concrete. Some illuminating results on the influence of the coarse aggregate on various properties of concrete are reported in an article entitled "Wear of Concrete Pavements Tested," *Public Roads*, May, 1924, by F. H. Jackson and J. T. Pauls. It will be noted that although the stone used in the 1:1½:3 mixture of concrete varied in per cent of wear (Deval abrasion test) from less than 2.0 to over 14.0, the crushing

strength of all of the stone concrete was at least equal to 4000 lb. per sq. in. and there was no greater crushing strength shown by concrete containing the hard, tough rocks than by that made with the sofest dolomite which had the following characteristics:

TESTS ON CONCRETE MADE WITH DOLOMITE

Per Cent Wear	Hardness	Toughness	Wt. per Cu. Ft. (solid)	Absorption	Grading
14.5	0.0	4	132	8.96	¼-1¼ in.

The crushing strength test was not made on this sample of stone, but the above physical values show this rock to be lacking in both hardness and toughness, and its crushing strength must also be low, yet the crushing strength of the concrete was apparently unaffected.

In a series of toughness tests made at the Bureau of Public Roads and reported by F. H. Jackson in the July, 1917, issue of the *Journal of Agricultural Research,* it was necessary to use a 2-in. cylinder of mortar 2 in. in height rather than the customary 1x1-in. cylinder as used in the toughness test for rock, because all mortars were less tough than the weakest rocks ordinarily used commercially.

Prof. F. E. Giesecke, University of Texas, has published data (*Engineering News-Record,* June 29, 1922) showing that with crushed stone ranging in crushing strength from 4400 to 33,600 lb. per sq. in. the crushing strength of concretes containing 6, 8, 10, 12 and 14 sacks of cement per cubic yard of concrete were practically identical. This was so even when the strength of the concrete greatly exceeded that of the aggregate.

It would seem that if the rock used as the coarse aggregate is as strong as the mortar portion of the mix the rock will certainly be amply strong. The following test limits are tentatively suggested as satisfying the above requirements:

ROCK SPECIFICATIONS FOR CONCRETE

Crushing Strength	Per Cent of Wear	Toughness
6000	8 (Fr. Coeff. 5)	5

Cross-Breaking Strength

With regard to the influence of characteristics of crushed stone coarse aggregate on the cross-breaking strength of the concrete, it is noted that the quartzite with a percentage of wear of less than 2.0 produced concrete with a modulus of rupture of over 600 lb. per sq. in. (677), while the softest rock, a dolomite with 14.5% wear, made concrete having a modulus of rupture of 599 lb. per sq. in., while the concrete having the highest value for modulus of rupture, 729 lb. per sq. in., had a percentage of wear of 6.3. It is quite evident from the results of Jackson and Pauls' report that modulus of rupture of concrete made of stone is not a function of the resistance of the stone to abrasion in the Deval abrasion test. The dolomite above referred to is far softer than is generally permitted in highway construction and yet it is stronger than the matrix and hence the strength of the concrete has not been affected by its low resistance. This has an important bearing on concrete road specifications, for it is apparent that considering the cross-breaking strength of the concrete alone the coarse aggregate can be at least as soft as the dolomite above referred to. There are, of course, other factors to consider in connection with aggregates for concrete roads.

Tension

No results have been found to show the influence of the characteristics of crushed-stone coarse aggregate on the resistance of concrete to direct tension. However, it has been shown that the modulus of rupture is unaffected and since modulus of rupture and direct tension are closely related it can be safely assumed that the tensile strength will be no more affected by the different characteristics of crushed-stone coarse aggregate than the modulus of rupture.

(b) *Concrete Exposed to the Weather.* If in addition to static stress concrete is to be exposed to the weather, then not only should the stone be structurally strong enough but in addition it should be resistant to the effects of the weather. In general, the most rapid weathering proceeds through the disrupting action of frost and of crystalline deposits within the pores and such actions are possible only where water is permitted to be entrained with the concrete mass. It has been shown that limestone, sandstones with a calcareous binder and even other rocks might be subject to decay due to the disrupting effect of calcium sulphate formed by the combination of sulphate dioxide with calcium carbonate in the presence of air and moisture. In the case of rocks other than limestone or calcerous sandstone the lime necessary for the formation of calcium sulphate is supplied from the cement. High porosity would accelerate such action. (See ROCK PRODUCTS, October 16, 1926, p. 94.) This applies more particularly to exposed building stone rather than to aggregate well protected with mortar.

Rocks having a high percentage of absorption and which at the same time are structurally weak are apt to weather rapidly. It is also claimed that there are some rocks which because of the presence of seams are apt to take up water and cause trouble through expansion of the concrete surface. Some types of shale also break down very quickly and an instance is noted by J. C. Pearson and G. F. Loughlin of the deleterious effects of a soda lime (labadorite) of the altered plagioclase variety. ("An Interesting Case of a Dangerous Aggregate," by J. C. Pearson and G. F. Loughlin, American Concrete Institute *Proceedings,* 1923.) An attempt is made to detect all unsound aggregates either by a freezing and thawing test or by an accelerated soundness test such as the sodium sulphate test.

Other soundness tests which have been proposed are:

1. The freezing and thrawing test.
2. The sodium chloride test.
3. The alkali test.

(See *Proceedings* of the Highway Research Board, 1924, p. 109, "Soundness Tests for Coarse Aggregate," by M. O. Withey.)

A number of tests for soundness of rocks made by the Minnesota Highway Department are also reported in the 1924 *Proceedings* of the Highway Research Board but are not conclusive in showing any relation between physical characteristics of rocks and soundness.

It is quite evident that much remains to be done in the development of a truly satisfactory test for the soundness of coarse aggregates. In the meantime if a rock does not withstand five immersions in the sodium sulphate test, the only really satisfactory test is the appearance of the rock as it is exposed on the ledge. If five immersions are withstood, the rock in all probability will be found to be satisfactory withstanding the weather and many rocks are also giving entire satisfactory service which do not withstand this test. It is suggested as a suitable requirement for the soundness of stone that it will be accepted provided an examination of the ledge or of structures in service shows it to be satisfactory or if it withstands five immersions in the sodium sulphate test.

(c) *Concrete Highways—Surface Abrasion.* The Arlington tests of the Bureau of Public Roads more nearly simulate the abrading effect of traffic on concrete roads than any other tests thus far made and the conclusions from these tests as they apply to stone concrete are as follows:

"1. That the rate of wear of stone concrete is, in general, not affected by the coarse aggregate provided the coarse aggregate is equal or superior to the mortar matrix in resistance to wear.

"2. That excessive wear will result from the use of very soft stone as coarse aggregate even though used in conjunction with a mortar of satisfactory quality. From the results of these comparative tests it would appear that stone with a percentage of wear over 7.0 should not be used in the wearing course of concrete roads.

"6. That small amounts of shale occurring in the coarse aggregate will cause both excessive and uneven wear.

"15. That the Talbot-Jones wear test is not, in general, an indication of the wear which takes place under traffic.

"16. That neither the crushing nor the transverse strength of concrete is a measure of its wear-resisting properties."

In drawing the above conclusions the authors considered only the effects of wear when tire chains were used on the wheels. There was no abrasive effect whatever on any of the sections under the action of the equivalent of 150,000 vehicles passing over the same wheel track. The indications are that the actual abrasive wear of rubber tired traffic is a negligible factor. However, the above conclusions are probably generally applicable with exceptions where local economic conditions make such exceptions necessary. For instance, in some localities there is no hard rock, tire chains are little used and the climate is not cold. Here the above limit of 7% wear might be raised at least to 8%.

D. A. Abrams, Structural Materials Research Laboratory, Lewis Institute, Bulletin No. 10, "Wear Tests of Concrete," states in conclusion No. 10:

Note: U. S. Bureau of Public Roads tests have shown the following results on soft rocks:

Sample Number	State	County	Material	Per Cent Wear	Toughness	Crushing Strength	Absorption, lbs. per cu. ft.
4197	Indiana	Lawrence	Argillaceous limestone	8.1	4	12,250	5.77
5027	Indiana	Lawrence	Limestone	6.4	4	6,900	2.97
5029	Indiana	Lawrence	Limestone	7.6	5	6,450	2.42

(See references)

"(10). The quality of the fine or coarse aggregate produced less effect on wear than is commonly supposed. The wearing resistance of concrete is determined largely by the *quality of concrete* rather than by the type of aggregate. Good concrete can be produced from aggregates which are generally considered inferior, if other factors are properly taken into account."

Obviously where there is very severe abrasive wear to be withstood such as in factory buildings, railroad platforms, particular sidewalks and floors, pavements carrying steel tires or wheels equipped with chains, a hard, tough aggregate is desirable.

(d) *Chemical Action.* Where concrete is subjected to chemical action the stone should be at least as resistant as the mortar portion of the concrete. For resistance to alkali effects the sodium sulphate test is directly indicative of the quality of the stone and the stone should be equally resistant as the mortar in the sodium sulphate test.

So far as resistance to acids is concerned, the same statement should be made—the stone should be as resistant as the mortar and this can be tested on an accelerated scale at least as satisfactorily as in the case of the soundness test. Among the chemicals having a deleterious effect on concrete are alkali and sea-water, animal and vegetable oils, tanning liquors, sulphite liquor, vinegar, sugar solution, molasses and various kinds of acids.

It is suggested as a requirement for stone coarse aggregate for concrete exposed to chemical action: "The crushed stone shall be equally as resistant as the mortar portion of the concrete when exposed to any particular chemical action."

(e) *Water Resistance.* The coarse aggregate might affect the water resistance of concrete:

1. By its effect on permeability.
2. By its effect on the durability of the concrete.

1. *Permeability.* A very comprehensive series of tests was reported by Prof. M. O. Withey in Bulletin No. 1245, Engineering Series, Vol. IX, No. 2, of the University of Wisconsin. It is shown by him that no matter what kind of coarse aggregate is used there is a fairly definite relation between permeability and crushing strength. Properly cured broken stone concrete of plastic consistency is shown to be impermeable when the crushing strength is 2500 lb. per sq. in. The grading of the aggregate to promote maximum density is also important and grading according to Fullers' curve is said to be beneficial. The characteristics of the concrete rather than the characteristics of the aggregate seem to be most important in producing impermeable concrete. However, soundness is an important characteristic and should be required of stone subjected to water action.

2. *Resistance of Aggregates to Water Action.* If the concrete is impermeable, water action then becomes primarily a surface phenomenon, except in the case of very porous and absorbent concrete. Its effects are chemical and physical. So far as the dissolving action of water is concerned, this is negligible on stone which will withstand disintegration in the weather. The percentage of absorption of the mortar matrix is so far in excess of even the softest, *sound* limestone aggregate that there is little likelihood of the aggregate ever being more soluble than the mortar. Stone aggregate subjected to water action should be sound and have reasonably low absorption for good results in concrete subjected to water action. There seems to be little to fear from the effect of freezing action on the stone in concrete provided the stone is sound, for the mortar is invariably weaker and of much higher absorption than any stone that will withstand the weather. Suggested special requirement:

1. Shall be sound as demonstrated by appearance of ledge or by successful use in structures or by accelerated soundness test.

(f) *Concrete for Fire Resistance.* Extensive work has been done on the fire resistance of concrete as influenced by the coarse aggregate. This work has been summarized by Committee E-4 on Fire Resistance of Concrete by the American Concrete Institute and that portion of the "Resumé" dealing with aggregates is as follows:

Resume

"The lessons that may be drawn from the studies so far made by the committee are that the fire resistance of concretes depends to a great extent on the kinds of aggregates used. Aggregates, such as the siliceous gravels used in the tests reviewed, result in concretes which are likely to spall rather quickly when exposed to fires. Small percentages of chert or other high siliceous aggregates mixed with aggregates which do not spall may still cause serious cracking and spalling. Sandstones and granites vary somewhat in affecting the fire resistance of concrete in which they are used as aggregates, but usually the results are slightly better than with the siliceous gravels. Both have the tendency to crack and spall. Hard-coal-cinder concrete does not show this tendency but transmits heat more readily, therefore does not give longer protection to the steel and structural concrete. Concrete made from blast furnace slag results in fire tests about equal to those of trap rock concrete. Both are decidedly better than concretes having the highly siliceous aggregates. In nearly all tests limestone has been shown to be superior to all the other natural aggregates in its fire resisting qualities. There is little or no tendency for the limestone concrete to spall or crack and its insulating value is generally greater. In fires of long duration the limestone aggregate near the surface becomes calcined and in some cases necessitates more surface repair to the protective covering than where trap rock is used, but these cases are the exception rather than the rule. So far as tests have been made it has been found that for rocks of a given mineral composition those of coarsely crystalline structure are not as resistant to fire as those of fine structure. Broken bricks or burnt clay aggregates give favorable results in strength and fire resistive properties."

All of the foregoing suggestions as to special requirements in specifications for stone are to be regarded as tentative, for they are based on rather meager information. As additional data are accumulated more definite recommendations will be made possible.

Problems to Be Solved in Connection with Specifications for Stone as a Coarse Aggregate in Concrete

1. What is the effect of dust-coated stone on the strength of concrete?
2. What is the allowable percentage of dust?
3. Define stone dust and standardize a method for its determination.
4. Standardize a truly significant soundness test for all aggregates.
5. What are desirable gradings for stone to produce?
   a. Greatest workability of concrete.
   b. Greatest yield.
   c. Greatest strength.
6. What is the effect of unsound particles and how large a percentage is permissible?
   a. In pavements.
   b. In exposed structures.
7. What is the effect of "flat" and "elongated" pieces and what percentage should be allowed?
8. What is a proper definition for "flat" and "elongated"?

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Requirements of Slag as an Aggregate for Concrete

Acting on instructions received August 4, 1926, from R. W. Crum, chairman, Committee E-5, the sub-committee on slag began assembling information and data on air-cooled blast furnace slag for all kinds and classes of concrete.

Although sincere effort has accomplished a relatively large amount of work, the committee feels that it has not been allowed sufficient time to cover, in an authoritative and exhaustive manner, the fields outlined.

That such condition obtains is due largely to the fact that there is apparently a wide range of opinion in the testing profession as to the value of certain tests on mineral aggregates. The committee, therefore, frankly leans towards placing their approval on tests of the concrete in which slag is the aggregate as the measure of the value of the material.

This after close observation of a great deal of the exposed portion of hundreds of examples of the tabulated 30,000,000 of cu. yd. of slag concrete and reinforced concrete, some of which now possess service history up to 25 years. As an indication of the sincerity of the attack on the problem, it may be stated that a part of the existing literature has been "analyzed and digested" under the following classifications:

CLASSIFICATION STUDY OF SLAG AS CONCRETE AGGREGATE

Abrasion	Elasticity	Sea Water
Abrasive Qualities	Expansion	Shape
Absorption	Fineness Modulus	Shear
Organic Matter	Fire	Size
Percussion	Flow Sheet	Solubility
Permeability	Fracture	Soundness
Bibliography	Geography	Specifications
Bond	Gradation	Specific Gravity
Bulking	Hardness	Stability
Cementation	History	Strength
Chemical	Homogeneity	Surface Area
Cleanliness	Impact	Temperature
Color	Melting Point	Tensile
Compression	Moisture	Texture
Compressibility	Acessibility	Thermo-Conductivity
Corrosion	Acoustics	Toughness
Corrosive Qualities	Age	Uniformity
Definition	Petrographic	Uses
Density	Possibilities	Voids
Desirability	Processing	Weathering
Durability	Production	Weight
Economy	Research	Workability
Efficiency of Tests	Rupture	Yield

Early in the work of the committee it was decided that a specification could not be developed or maintained without a most comprehensive survey of what had been written about the material for all uses to which it had been placed. Seemingly no detail of production, processing, chemical analysis, physical limitations, service history or laboratory data of any sort could be discarded as worthless or inconsequential. For this reason the work accomplished, and further outlined, involves the study of such more information than was indicated as necessary in the original instructions to the committee.

H. J. Love, chairman of the subcommittee on slag, submitted a very lengthy and exhaustive report, which was not printed for inclusion in this year's report of the aggregate committee.

Problems of Too Much Plant Capacity

Our Ability to Over-Produce Frequently the the Cause of Bad Business and Poor Prices

By F. C. Biggert, Jr.*

WE often hear that in certain lines there is "over-production," and this is given as the reason for poor prices and bad business. Now, really there is never any great amount of over-production, by which I mean that substantially everything that is produced is actually used. But there is, in a very real sense, such a thing as "over-producing capacity," and is a frequent cause of poor prices and bad business.

In many industries there is over-producing capacity today in this country, and while the past year has been prosperous in the main, there are businesses which have suffered from over-capacity, even under these generally good conditions. The coal industry is an instance of over-capacity.

There are numerous causes which have built up these over-capacities. Some temporary stimulation has induced the building of more and more producing capacity until, due to some change of conditions, the industry suddenly finds itself able to produce much more than is needed.

It would be unfair to say that the existence of so many industries, with excess producing capacities, indicates a lack of business foresight on the part of the American business man. We have a growing country and one in which conditions may change suddenly, so that the best of foresight may not correctly visualize even the near future. But now the lesson is written large, and he who runs may read. We may therefore hope that, as the weaker units of our excess capacities are eliminated and as the country grows, we may be spared a repetition of the present uneconomic condition, at least in our basic industries.

Another interesting angle of our fiscal situation is the singularly isolated position we occupy. There has never been a nation so self-sufficient as we. That is to say, there has never been a nation which could so nearly produce all the things it needed.

Also, there has never been a nation which had developed such a high standard of living as we, by which we mean that we consume more goods per person than any other nation has so consumed.

Also, there has not, at least since Rome's greatness, been a nation, which owned and possessed so large a part of the world's gold as we now do.

Our Self-Dependence Isolates Us

Now, all of these conditions seem highly satisfactory, and yet they are conditions which naturally isolate us from the people of other nations.

If we can produce nearly everything that we need, we will evidently have comparatively small and rather one-sided commerce with other nations. If we have a higher standard of living than other nations, they will naturally be somewhat envious.

If we have a disproportionately large share of the world's gold, we must expect to buy as much from other nations as we sell to them, else we would soon have all the gold. And yet, because of our enormous producing capacity, it is very desirable that we sell more than we buy.

The net of all these ifs is that we appear to be in a position where we must expect to work more and more for ourselves and by ourselves. There does not appear to be any great difficulty in doing this, but it is navigating uncharted waters. Heretofore industrial nations have worked on the basis of exporting their excess production to the less developed peoples.

We may find ourselves in the position of the crack marble-shooter who had won all the commies from all the kids in town, loaned them all the commies and won these all back again. The gang just had to beat him up and relieve him of his excess marbles before any more marble-shooting could be done. And as for the loans, they are not collectable.

*President United Engineering and Foundry Co., Pittsburgh. The article is reprinted from "United Effort," a publication of United company.

Gradation of Machine-Broken Stone

Part I—Thorough-Going Study of the Percentages of Various Sizes Produced in Jaw and Gyratory Crushers

By Wm. T. W. Miller
Sheffield, England

WHEN preparing the flow sheet of a crushing and screening plant of any size it is essential that the designer should have a reasonably accurate idea as to the percentages of the various sizes which he may expect to find in the product after each crushing operation. If the plant is to work successfully it is necessary that each unit should be in balance with the other machines in the series and the closer and more accurate the calculations the more economical the plant will be both in first cost and in operating charges.

The dimensions of the screens and bins, the proportions of the elevators and conveyors, the size and character of the secondary crushers, and the power of all subsidiary motors, will depend largely on the screen analysis of the products from the preliminary breakers.

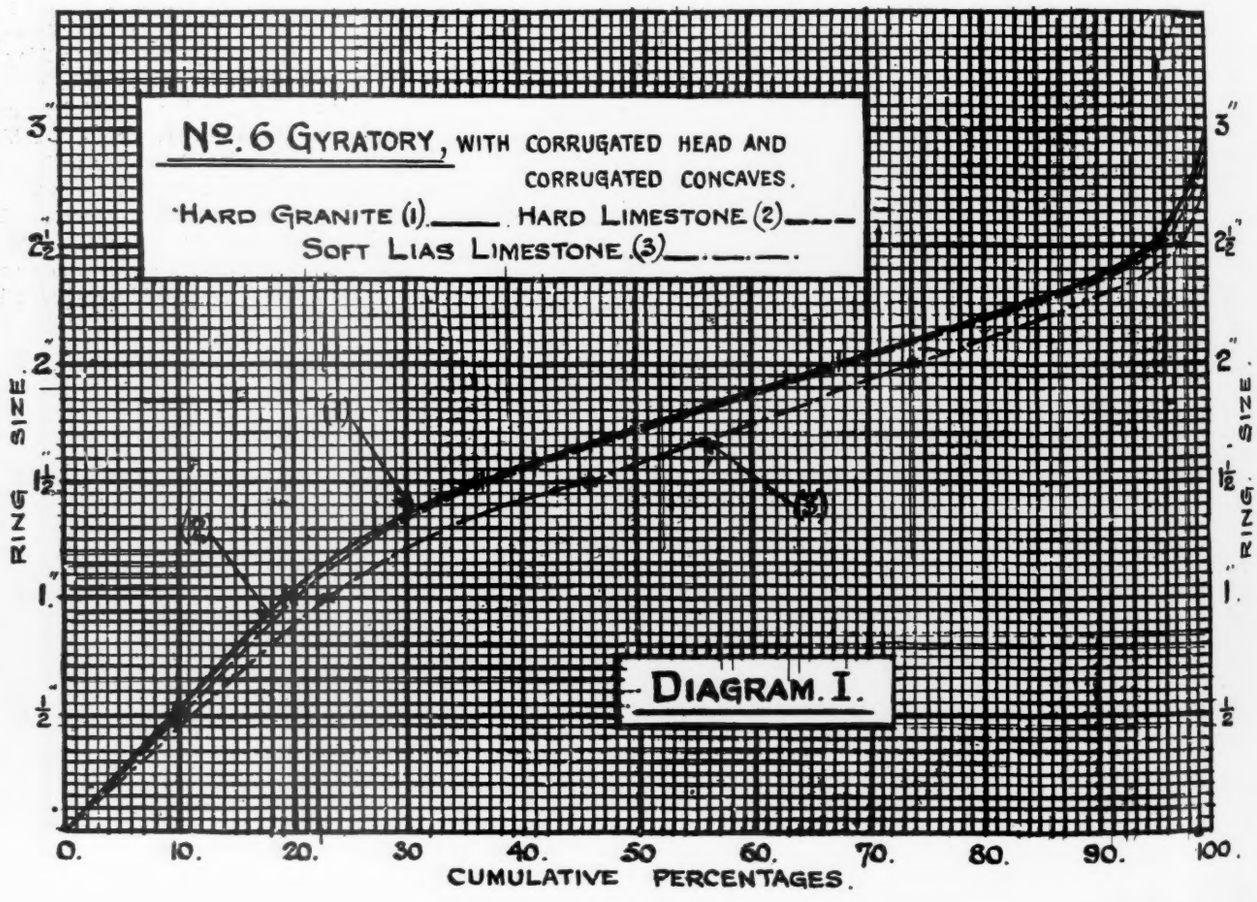
Whilst it is hardly possible, when dealing with so many grades of material under such varied conditions as exist in the quarrying field, to estimate exactly the gradation of the product from any crushing machine, a good deal of information has been collected which may be helpful to the engineer in the preparation of preliminary plans for any reorganization of the reduction machinery.

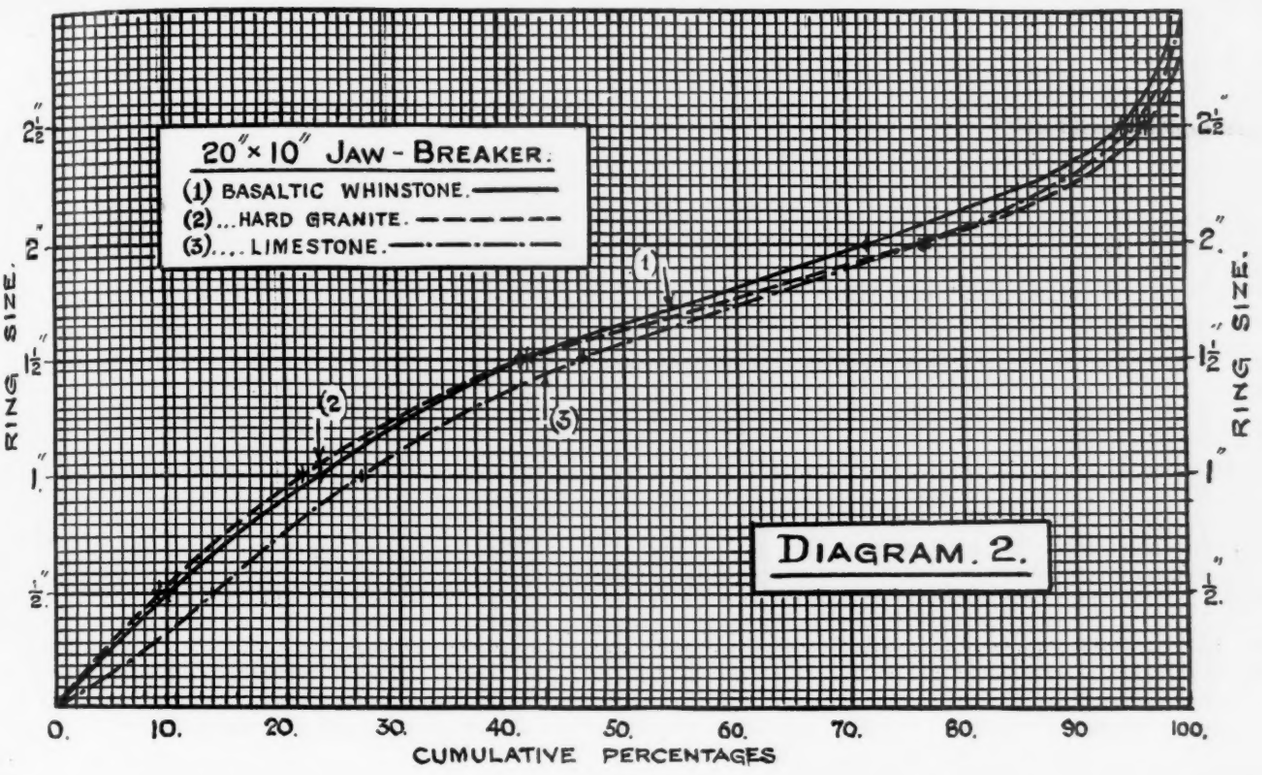
When considering the subdivision of the product into the different grades which constitute the mass it is natural to assume that the efficiency of the screens is as nearly perfect as possible. This ideal is rarely attained in any grading plant, the average efficiency of the coarse sizing sections in revolving screens is seldom more than 80%, and in separating the finer products the screens in many installations fail to reach so high a standard. It is necessary therefore to point out that, unless otherwise stated, the results plotted in the following diagrams have been obtained by hand-screening bulk samples over flat sieves. The proportions are therefore as nearly accurate as is possible in work of this kind, but due allowance should be made for the difference between ring size and screen hole diameter if revolving screens are contemplated, although, if the average screen efficiency is maintained over the whole range

Introduction

WM. T. W. MILLER, the author of this series of articles, for the past 18 years, has been engineer in charge of the crushing machinery department of Messrs. Hadfields, Ltd., Sheffield, England. For this company he has worked in Canada, the United States, Brazil, Uruguay, the Argentine, France, Spain and Portugal. He is a member of the Institution of Civil Engineers and of the Institution of Mechanical Engineers.

To a certain extent these articles supplement the series, published in Rock Products during 1926, by Hugo W. Weimer on the design of crushing plants. They give the results of what is undoubtedly the most extensive study of the subject thus far made, a study which is now being recognized by American crushed-stone producers as very essential to the efficient operation of their plants. —The Editors.





of sizes the contour of the diagram would remain unaltered.

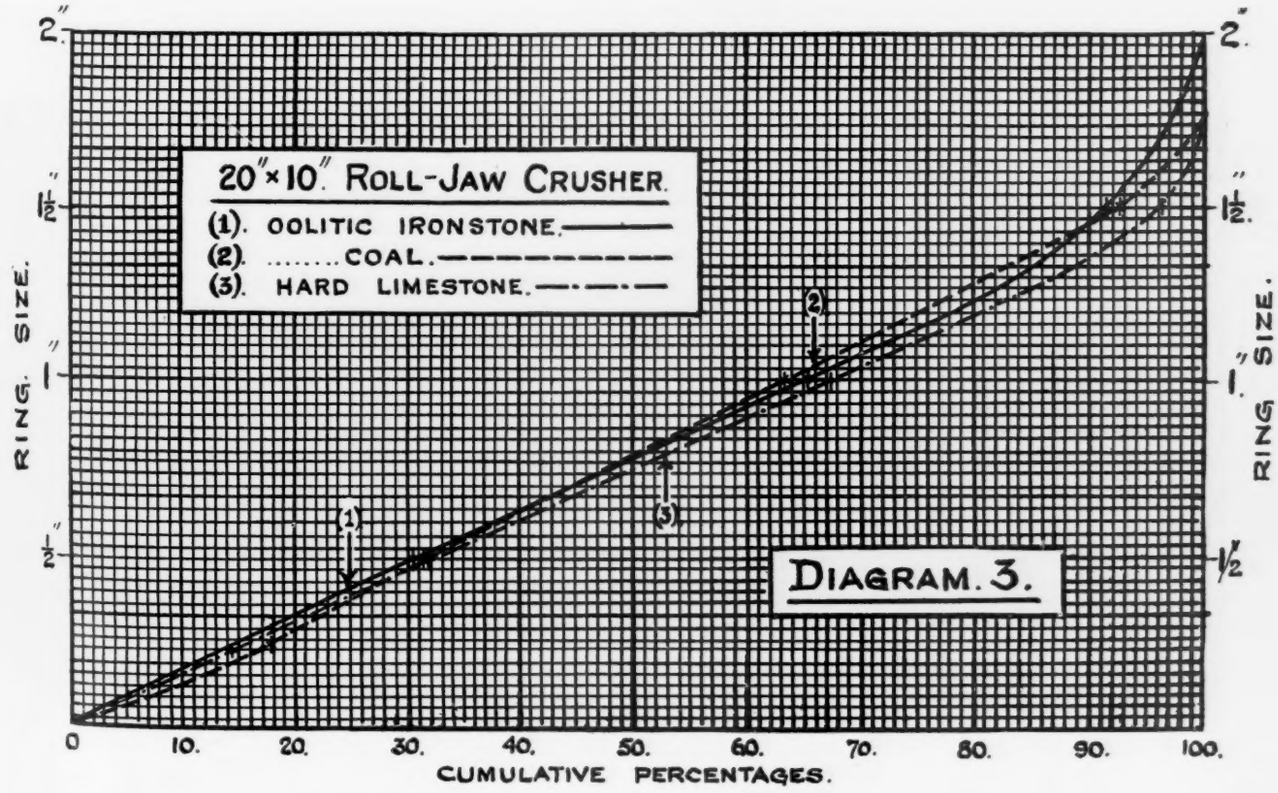
Little Difference Between "Hard" and "Softer" Rocks

It is natural to assume that the character of the material which is being crushed will have an important bearing on the proportion of fine material made by the shattering of the larger blocks between the crushing faces.

After plotting a great number of tests it is surprising to find how closely the results agree for the homogeneous rocks although these may be widely separated in the hardness scale and in no sense comparable under compression tests.

It is true that where the rock contains a mineral of a different character to the gangue or matrix, as for instance galena in quartz, and, particularly in those cases where the mineral content is high, the proportions may be affected by the varying behavior of the two materials under the breaking action, but, in the range of crushing to one quarter of an inch and under, the variations are not so great as is sometimes imagined.

The diagrams which follow are not plotted from laboratory tests, they are the results in most cases of trial runs under working conditions, the samples taken for screening varying from one half to one ton at a time.



In some instances the records represent the average output over a lengthy period of operation.

Diagram 1 shows the results of three representative tests on a No. 6 gyratory crusher fitted with corrugated head and concaves in practically unworn condition. In each case the feed consisted of large clean stones of a size approaching the maximum which could enter the space between the cone and the concaves.

The variation in the crushing strength for the granite and the softer limestone was very considerable, yet the results practically coincided as is shown by the diagram.

As will be shown later the gradation curve changes when the crushing surfaces are smooth and as wear takes place on the head and concaves the proportion of fine material increases.

In Diagram 2 the crusher was a 20x10 in. Blake type jaw breaker fitted with a straight fixed and a curved swing jaw both having teeth in good condition, and the pieces of rock fed to the machine would compare as nearly as possible with those used for the gyratory tests. Here again the records cover three materials varying in character.

It will be noticed how nearly the curves in this diagram agree with those on the preceding one, proving that for straight action reciprocating breakers, fitted with crushing faces of like construction, a similar curve will apply to a wide range of materials.

It is necessary to emphasize that this particular combination of jaw faces makes less fines than the usual straight jaw plates and that wear on the teeth has a considerable bearing on the finished product. Both these factors should be borne in mind when comparing the contour lines.

Continuing the investigations with a crusher having a different movement, Diagram 3 covers a third series of tests on three materials of varying character, the 20x10 in. breaker used in this instance having the jaw-stock supported on the rotating eccentric shaft. With this mechanism the crushing stroke follows an elliptical path instead of the direct backwards and forwards motion in the Blake machine.

This rolling movement has some influence on the form of the curve, and the closer setting of the jaws affects the contour lines, but the graphs for the three materials coincide in a remarkable manner.

The results of these nine tests should be sufficient to show that the nature of the material being crushed does not change the gradation curve to the extent usually imagined and that other reasons must be sought for any radical departure from the average diagram.

(*To be continued*)

Group Insurance With Added Feature of Pension Insurance

By W. E. Farrell

President, Easton Car and Construction Co., Easton, Penn.

ON PAGE 63 of your February 20, 1926, issue, you described the group insurance plan in force at the Charles Warner Co. plant. Because I thought publication of a somewhat similar plan by a manufacturer of quarry equipment would be interesting, I turned this page over to the Travelers Insurance Co., who carry our insurance, with the suggestion that they describe what they are doing for us, as it would doubtless be interesting to many industrial organizations in the rock products industry, particularly the smaller ones, with which arrangement for old employes' pensions is something of a problem.

The interesting and novel combination of insurance, together with provision for old age pensions, in successful operation covering the employes of the Easton Car and Construction Co., may be described briefly as follows:

The arrangement really combines two separate and distinct plans: (1) *Group Insurance,* rewarding past service immediately, the entire premium paid by the employer, covering all employes; (2) *Pension Insurance,* employer and employe sharing premium, optional with the employe, rewarding future service by increase in the employer's contribution.

Under the group plan a certain amount of life insurance is given to every employe, without cost to him, if he has been six months or more in service. This amount ranges from $500 after the six-month service period to as high as $2,000 for ten years or more of service. Individual policies are issued to each employe and each policy contains a disability clause providing for settlement with the individual himself in case of total disability. The beneficiary is named therein, and the policy may be converted to any regular form issued by the insurance company without medical examination if the employe leaves the employer.

Group Insurance Plan in Brief

(1) No physical examination required.

(2) Entire cost paid by the company.

(3) All employes insured after six months' service.

(4) Amount of insurance ranges from $500 to $2,000.

(5) Provides for payment to employe in installments in event of total disability.

(6) May be converted when leaving employ.

Service Formula Under Group Plan

After 6 months.	$ 500	After 6 years,	$1,200
After 1 year,	600	After 7 years,	1,400
After 2 years,	700	After 8 years,	1,600
After 3 years,	800	After 9 years,	1,800
After 4 years,	900	After 10 years,	2,000
After 5 years,	1,000		

and continuing at the maximum thereafter.

Pension Plan

Under the pension insurance plan any employe (after six months' service) may obtain additional life insurance under the wholesale salary allotment plan, the employer paying part of the premium and the employe the balance. The employe may purchase as high as $10,000 under this plan, without medical examination, but the employer agrees only to contribute a maximum of $2,000 of insurance, this size policy providing an annuity of $400 per annum. The minimum amount which may be had under the company contribution plan is $500 of insurance carrying annuity payment of $100 per annum. This pension form of insurance provides life insurance on an increasing basis up to age 65, with a lifelong old age annuity thereafter. In the later policy years the face amount of the insurance increases to more than double its original amount, and the policy has very liberal cash and loan values after the second year.

The employer undertakes to advance 20% of the monthly premium the first year, increasing this contribution each year of continuous service thereafter. The employe's share of the premium is deducted monthly from his salary and is remited direct by the company, together with their contribution, to the insurance company, the insurance company writing both the group and pension insurance. An agreement with each individual provides that the advances made by the employer shall be refunded either by the individual or from the cash value of the policy, in event of employe leaving the service of the company.

Pension Insurance Plan in Brief

(1) No physical examination required (under age 50).

(2) Possible to secure up to $10,000 life insurance.

(3) Company pays part of any amount from $500 to $2,000 of insurance, with maximum pension of $400.

(4) For permanent disability premiums cease and yearly income of $120 for each $1,000 insurance paid.

(5) Employe's share deducted monthly and remitted direct to insurance company.

(6) May be continued on monthly basis when leaving employ.

Service Formula Under Pension Plan

1st year company pays 20%
2nd year company pays 22%
3rd year company pays 25%
4th year company pays 28%
5th year company pays 31%
6th year company pays 34%
7th year company pays 37%
8th year company pays 41%
9th year company pays 45%
10th year company pays 50%

increasing 1% yearly thereafter, up to a maximum of 70%.

Under this service formula at the time of maturity of the policy, namely, age 65, the company has paid 50% of the total payments; in other words, contributed dollar for dollar towards the procurement of the maximum pension of $400 plus the additional insurance protection during the period.

The combination of these two forms of insurance should work out advantageously to both parties. It gives the employe an opportunity to materially increase his insurance protection for the benefit of his family, at a very low cost and on a monthly payment basis, and at the same time to be building up an old age fund. The employer, at a relatively small outlay, can provide for the care of the faithful old employe, if he loyally stays with him, but at the same time limits his expenditure to practically nothing if the employe leaves.

United States Gypsum Company Cultivates Its Foremen

PRESENTATIONS of diplomas to 60 superintendents, supervisors and foremen were made recently at the closing session of the Foremen's Round Table of the United States Gypsum Co.

A banquet was served at the Atlantic Rotisserie, Stapleton, N. Y. (Staten Island), and the awards, earned for consistent attendance at the periodic gatherings of the department heads, were presented by George L. Hann, works manager at the New Brighton plant, who acted as toastmaster at the banquet.

A series of twelve meetings have been held during the past six months, the object being to acquaint the men with the Gypsum company methods and ideals, and to permit the heads to learn the workings of the departments other than their own. Talks given at these gatherings by company officials were designed to aid the foremen in promoting closer co-operation between themselves and the workmen, to the mutual advantage of both.

In presenting a diploma to John Jakubowski, Mr. Hann noted the fact that the recipient had been employed by the company for thirty-two years. For the past twenty-eight years he has been foreman of the calcine department and since being placed in charge he has not missed a day from his duties.

The following received gold seal diplomas for perfect attendance at the twelve meetings: G. L. Hann, T. T. Youngfelt, Floyd Thorman, A. L. Fischer, Edward Webb, Thomas McCormick, Harry Martin, Charles Dunham, J. Cicero, S. M. Anderson, A. Chevalier, E. Ross Farra, J. W. Roberts, Ben Johnson, Harry Watson, S. W. Fancher, O. Glen, Ray Beswick, J. Firelay, J. Thorson.

For attendance at nine or more of the meetings the following receiced red-seal diplomas: A. W. Evans, J. J. Wagner, E. R. Davis, H. B. Kearns, John King, W. L. Tyson, J. Lazerski, J. Egan, J. Javuresky, G. Bentley, B. Kasauke, A. G. Larsen, A. J. Popp, William McKendry, J. Stanford, William Barge, R. H. Rector, R. Meisenheimer, F. Patchin, H. De Groat, John Stanton, J. Jakubowski, T. Barteldt, F. C. Reinking, W. O. Decker, J. Merrill, J. Hetzel, T. Larsen, F. Klenke, A. Pembroke, E. Witter, S. Merke, A. Kirschner, William Brill, W. Koster.—*Staten Island* (N. Y.) *Advance.*

Quarry Operators Fight Proposed Blasting Law in Montreal

EFFORTS to prevent the city of Montreal from adopting the new quarry by-law, adopted by the executive committee in December last, and awaiting confirmation by the city council, were launched by the Montreal Builders' Exchange, when a delegation waited on the city public works committee and tabled a list of objections to the proposed by-laws.

Heading the delegation was A. F. Byers, president of the A. F. Byers Construction Co. and one of the directors of the exchange. He was supported by R. F. Dykes, of the T. A. Morrison Quarry Co.; A. Plamondon, consulting engineer; Leon Gelinas, secretary-treasurer of the Consolidated Sand Co.; E. Labelle, of the Montreal Quarry Co.; T. Boutet, of the Villeray Quarry Co., and D. A. Paterson, secretary-treasurer of the Builders' Exchange.

Under the proposed by-law, Mr. Byers contended on behalf of the delegation, all quarries operating within the city limits would be put out of business by article 7 of the by-law, which reads: "No blasting in connection with the operation of any quarry within the city limits shall be done at a distance of less than 3000 ft. from any building whatsoever." It was this article particularly to which the exchange was opposed.

Nine objections were then presented by Mr. Byers, as follows:

(1) The fact that certain quarries have been operating within city limits long before buildings were erected within 3000 ft. of their site.

(2) The fact that building operations have encroached on recognized quarry areas.

(3) The right of property constituted in long-established quarries and the immense capital sum invested therein.

(4) The loss on the part of labor by adoption of this article.

(5) The loss to city building through inability to quarry this splendid building stone and products manufactured therefrom, such as cement and artificial stone and cement blocks.

(6) The increased cost to the public of building materials by the adoption of this article.

(7) The fact that existing quarries, the records of which are free from careless practices resulting in injury to persons or property beyond their confines, are deserving of special consideration and treatment.

(8) The geological nature of the island of Montreal being such that rock strata lie within a few feet of the surface of the soil, thereby rendering necessary blasting operations of a major character in the conduct of excavations for foundation purposes in densely peopled localities, it would be invidious to forbid the operation of quarries, properly conducted, in areas sparsely populated and in regions more or less confined to such operations.

(9) In conclusion, it is respectfully claimed that the right to a permit to operate a quarry within the city limits should be determined by (a) the record of the owners; (b) the capacity of the owners to conduct operations with due respect to the lives and property of others; (c) compliance on the part of owners with all regulations for operation and the adoption and practice of all feasible devices to insure public safety.

Consideration of the objections was promised.

Los Angeles City Fathers Propose to Control Gravel Industry

THE effort of the Los Angeles (Calif.) Board of Supervisors to create an ordinance regulating the location and operation of rock-crushing plants had been met with stern opposition on the part of a large number of the smaller and new rock and gravel concerns.

Charges of "favoritism" and "freeze-out" were hurled at the supervisors by legal representatives of these firms when the ordinance was brought up for passage.

The ordinance provides that no new rock-crushing plant can be built in the county, nor can any now in operation be enlarged without an especial permit from the Board of Supervisors.

Attorney L. A. Lewis, representing one company, stated that the ordinance in itself would make no difference to the smaller companies if it were correctly enforced, but that it opened up the way for gross discrimination.

Supervisor Sidney T. Graves, who was responsible for the ordinance being drawn up, vehemently denied that there was any discriminatory intent. The ordinance, he said, was for the sole purpose of keeping crushers from locating near hospitals, residential districts and river beds.—*Los Angeles* (Calif.) *Express.*

Systematic Market Analyses and Sales Promotion*

The Use, Abuse and Comprehension of Industrial and Market Statistics—With an Example of a Practical Crushed-Stone Market Survey

By Arthur Livingston

STATISTICS play an important part in market analysis. Business, however, has passed up the use of figures rather shamelessly. There is a great deal of attention given to salesmanship, the training of salesmen, salesmen's conventions, advertising, advertising stunts, sales manuals and the like, which are all needed; but figures and their potency are lost sight of in the every-day rush of selling goods.

Object of Collecting Statistics

Many concerns have arrived at the place where they maintain their own statistical departments for the sake of market analysis. They attempt to find out chiefly:

(1) Where they ought to get business from.
(2) How much they ought to get.
(3) How much they are getting against their ideals.
(4) Where their weak points are.
(5) The sales man-power they ought to have.
(6) Where that man-power should be placed.

These things are possible in a well-arranged statistical department. We have heard the need of statistics derided, yet there is a lot of debating going on in sales departments that could be decided quickly and decisively by a few figures bearing on the proposition. There may be a great many human opinions about the advisability of doing a certain thing, but figures on the subject will tell only one story, and that one is the right one.

Most sales work is simple. It is quite the same wherever you go. There is the sales manager, his salesmen, the selling talk, the demonstration of the product, the prospects and the calling on the prospects. There is really nothing complicated about a sales organization. The prescription as to what makes up a sales department is not a secret; everybody knows it. The factor which makes one department successful above another is sales arrangement. Sales management is greater than salesmanship. Sales managing is more than talking with dealers, satisfying customers, making loud speeches to salesmen; it includes a thorough knowledge of markets. It includes a thorough knowledge of where business can be secured, how much can be secured in each place, and from whom you are going to get the business. This kind of knowledge is born of good statistics.

Some Problems Figures Don't Solve

While sales analysis is a big part of market analysis, it is not all of it. Some kinds of market problems cannot be solved by figures. Figures may not be avoidable, but perhaps the problem cannot be reduced to terms of figures. In this case the "field investigation" is resorted to. This is quite a tool for market analysts and they employ it to decide many questions.

One concern's business started to decline and continued to do so. They had no idea what caused it; their sales department could not offer any reason except that the article was priced too high, the usual complaint from sales departments. They resorted to a field investigation. About forty calls were made in two weeks' time, from which two important things were learned (that is not enough calls, but the idea was simply to find out what might be causing the decline), one, the consumers of the product had begun to discount the value of the product. They admitted that it was an excellent piece of merchandise, but they would not admit that economically it was the best thing they could use, which was the very thing this company had been preaching for years. They had attempted to show, and did show for a great many years, that it was economy for the purchaser to buy their high-priced goods; and now their customers were slipping away from them, using lower priced substitute goods.

Don't Neglect the Enterprising Small Competitor

Too, they found a new form of competition had come into the picture and was meeting with very good success. Therefore this company as a result of this survey knew in what direction to strengthen their sales arguments and learned how to rearrange their advertising to meet a new condition. They may even have the good sense to change their product so as to minimize the opposition of their ambitious competitors. On the other hand, they may be victims of that sense of superiority so many leaders in industry have, where they feel themselves above following in the footsteps of a small competitor who has conceived a bright idea and is making good on it.

It took one concern five years to wake up and bring out a product like that of a small competitor, and by the end of that time the small competitor had grown big and was making himself a factor in the trade.

One-Man Surveys Better Than Large Staff Surveys

With many field surveys it is the practice to send out crews of men, six or seven, into all parts of the country, armed with a certain manner of approach and intent on getting certain specific information. But when these men turn in their reports there is so much to read and digest that it often develops that the people interested haven't the time to read and digest the extensive report, and the full benefits are not realized. Some people depreciate the value of this kind of a field survey. A better way is to send out one man, and have him get the facts, and instead of asking him to make a report, ask him to interpret his findings and suggest a plan of procedure to carry out needed objectives.

There is one other market analysis tool which is used frequently, and that is the questionnaire. When you need to know the consensus of opinion regarding some idea, you might send out general questionnaires. The questions can be framed in such a way that what you seek to know may be gained quickly and at little expense.

Specific Suggestions for Crushed-Stone Sales Promotion

Crushed-stone producers are interested in sales, production, and costs of distribution. As a group and individually they would like to have more sales, larger production, and lower costs of distribution. Some help on these problems can be had through the use of a market analysis. The sales territory may be mapped out to show every possible source of business and what its volume runs. Every point of production and the costs of reaching surrounding markets and the costs of reaching far-away markets may be determined. The territory may be zoned and each

*Abstracted and adapted from a discussion at the Detroit (1927) Convention of the National Crushed Stone Association.

zone broken up into smaller divisions, possibly counties, showing what is in these smaller territories which would be of interest as a source of business.

New applications of crushed-stone products may be sought through the aid of a chemical research laboratory. It may be desirable to have visualized all the present uses to which these materials are put, with a view to studying each carefully to see if there is anything to be done to better the finished product.

Developing a Market for Screenings

By E. T. NETTLETON
Connecticut Quarries Co., New Haven, Conn.

Two or three years ago we had what you might call young mountains of trap rock screenings up at our quarries. I don't say that we have reduced them all, but we have taken more out of those mountains than we have put in, especially during the last year. When we first turned our attention to it, we thought that we would take the dust out and market a ¼-in. stone. Our screenings run from ⅜-in. down to a fine dust like cement. In taking the dust out we produced a ¼-in. stone. There was a small market for it, but this could not be produced in bad weather or in the spring of the year. The price we could get for this was not enough to pay for the trouble of making it.

The next thing we looked into was the possible substitution of these screenings for fine aggregate for concrete. We went into this and had tests made. We found out that the amount of screenings was approximately 10% of our entire output of stone. We have six quarries with a daily output of 3000 or 4000 tons, but by the time we had taken out sufficient dust from these screenings to make it acceptable for concrete work, the amount of the product was so small that it would not take care of one fair sized concrete road job. So we gave that up.

We then started on asphalt roofing shingles. Lots of companies around us were making rubberoid shingles of one kind or another. We got in touch with several of these concerns which use roofing granules and found out that it is the color that they are after, and our dark, grayish blue stone did not appeal to them.

We knew that chicken grits were bringing a pretty good price, and we thought we might get a little business there. Unfortunately, we found out that chickens took a fancy to light colored stone. They preferred white and would not pick up these trap-rock chips off the ground. It was impossible to change the chickens' mind, so we gave that up.

What we did do, finally, was to go out and market these screenings, including the dust just as it came out. The prices were good. We didn't go out and try to make any large sales; we just went out into the small towns where they had streets to pave and their funds were limited.

In these towns where we sold one or two carloads, every one of them came back for more; which is evidence that there is some value to it.

Now we spread these screenings on 2 to 3 in. deep on unpaved streets and roads. We do not want to put them on thicker because they would not roll down good. It is a very cheap product. By the time it gets on the road it costs between 20 and 30 cents a square yard.

Minnesota Research on Gravel and Concrete Roads and Aggregates

AT the present time the Minnesota State Highway Department laboratory is carrying on the following investigations in cooperation with other agencies:

1. Effect of tensile strength of cement on the strength of concrete.

2. Standardization of field transverse concrete beam testing machine and method for use.

3. A new method of testing sands using water cement ratio.

4. Use of calcium chloride integrally as an admixture and curing agent.

5. Study of fluid cement water mixtures as a criterion of the concrete making value of portland cement.

Independently of other agencies we are conducting the following investigations:

1. *Effect of shape and character of aggregate on resulting strength of concrete.*—Compressive and transverse tests are being made, using, under identically the same conditions, a smooth, uncrushed, impervious, igneous gravel as coarse aggregate, a crushed limestone, a crushed trap, a commercial gravel containing cracked oversize, and a porous sandstone. The specimens are all broken at 3, 7 and 28 days. Results will be available about April 1, 1927. In these tests the absorption of aggregate is being allowed for in computing water cement ratio.

4. *Bituminous treatment of gravel roads and earth grades before graveling.*—This we consider the most important and far-reaching investigation that we are carrying on. In this state we have a trunk highway system of approximately 7000 miles, of which there are about 850 miles paved and over 5200 miles of gravel. In some localities gravel is scarce and expensive and its conservation is very important. Some of the gravel roads should and will probably soon be paved, as they are carrying very heavy traffic. There still remains a large mileage where the traffic is not heavy enough to justify paving and yet the gravel surfacing is unsatisfactory, both on account of the cost of the gravel and the dust nuisance to motorists and residents along the highway, as well as the inability to maintain a smooth riding surface at all times. The gravel as used in this state contains from 40 to 75% passing a No. 10 sieve, so in many instances there is not much actual metal in the surface. In addition, there is a considerable variation in the quality. It is placed on all kinds of subgrades from heavy clay to granular soils. We are attempting to determine the best materials to use for various conditions of gravel and subgrade. In 1926 we constructed 81 miles of tar on gravel, 66.5 miles of oil on gravel, and 61.5 miles of oil on earth subgrade just previous to graveling. Several different kinds of road oil were used. Careful records of application procedure and maintenance costs are being kept. Bituminous materials and soils are analyzed. This investigation will be continued, with special observations during the spring breakup on heavy soils. The investigation was started in 1924.

5. *Vibrolithic pavement.*—In October, 1921, about 2200 ft. of Vibrolithic pavement was constructed, using different proportions and different kinds of aggregate. In this 2200 ft. ten different sections were laid. The effect of lean mixtures is now apparent. There has been no maintenance up to the present time except filling cracks.

6. *Concrete pavements.*—Concrete pavements have been under observation for several years. As a result of study and observation we are now constructing contraction joints every 40 ft. 4 in., making the opening clear through the slab and filling the surface where a cap has been removed with bituminous material. Pavements similarly constructed about three years ago with longitudinal joints are practically free from cracks.—*Highway Research News.*

New Heat Resistant Whitewashes

THE results of an extensive series of tests conducted to develop an economical and durable heat-resistant water paint or whitewash will be presented at the Richmond meeting of the American Chemical Society. The paper by E. P. Arthur, formerly of the staff of Ohio State University, is part of the symposium on lime to be held by the industrial division, April 13 and 14.

At various points in practically all industrial plants there is a need for surface coatings which will withstand temperature above those which destroy ordinary oil paints. Large numbers of such coatings have been recommended, but objections may be found to most of these on the basis of cost, each of application, light effects or durability.

The refractory properties of lime and the whiteness of films obtainable with whitewashes led to a study of the possibilities of adapting such coatings for use on surfaces subject to high temperatures. Very satisfactory results have been obtained and formulas have been developed which produce films that are standing up after several months' exposure under very severe conditions. The fields for application of these high temperature whitewashes are numerous and the deails of these investigations will be of direct interest to all industrial chemists.

Combination Cement Slurry Dryer and Clinker Cooler

A Description of an Apparatus Which Has Interesting Possibilities

By H. G. Loeffler and A. C. Eichenlaub
Pyramid Portland Cement Co., Des Moines, Iowa

PORTLAND cement slurry contains ordinarily from 30% to 35% of water. The advantages of adding this water to the raw materials and using the slurry or wet process are in the elimination of pre-drying of raw materials as in the dry process, keeping dust at a minimum, particularly in the kiln stacks, and in the production of a high quality, chemically uniform cement with raw materials from quarries quite varied in composition. Thus it spreads the producing area of cement. It gives the assurance that kilns can be fed with material which has the same percentage of lime in every barrel of the entire production hour after hour, day after day. This allows greater production and a better product, and these advantages are sufficient to cause many manufacturers to choose the wet process in preference to the dry.

Wet and Dry Process Compared

However great the advantages of anything, usually there are also the disadvantages; the disadvantages of the wet process showing themselves when the slurry gets to the kilns. For every pound of water in the slurry there is consumed from the heat in the kiln 1150 B.t.u. The higher the moisture in the slurry, the greater is the length of wet zone in the kiln, and consequently the calcining zone becomes shorter.

Driving off the CO_2 from the raw materials is perhaps the greatest and hardest work done in the kiln. The time and space for this reaction are both greatly decreased because of the water in the slurry. An extremely long rotary kiln is used in the wet process which shows considerably less production in comparison with a kiln of equal size operating under the dry process. The advantages of the wet process on the raw materials from the storage to the kilns are quite considerably offset when there is placed on the other side of the balance its disadvantages exerted on the kiln.

The following table allows for a fair comparison between the wet and dry process.

COMPARATIVE DATA ON DRY AND WET PROCESS

	Dry	Wet
Average raw fineness, 100 mesh	95.33	96.28
Average sq. ft. of kiln surface	2919	4628
Average kiln output, bbl. per hour	33.74	43.42
Average B.t.u. per bbl. of clinker	1,343,994	1,760,578
Average sq. ft. kiln surface to burn one bbl. of clinker per hour	86.5	108.8
Average output in bbl. clinker per hour per sq. ft. of kiln surface	.0115	.0093
Average per cent of operating hours	88.3	87.9

Data for above results taken from "Descriptive and Operating Data on 544 Kilns in Member Plants for the Year 1925." Compiled by Committee on Conservation, July, 1926, Portland Cement Association.

It will be seen from the foregoing table that of two kilns of equal size, the dry process will produce approximately 25% more at a slightly coarser fineness and use about 23% less B.t.u. at nearly the same per cent of operating hours, in spite of the fact that its feed is not as uniform as that of the wet process. The tendency today, however, is toward the wet process.

Up to the present time the most efficient way of taking care of the moisture in slurry appears to be in feeding it directly into the kiln and using the back end of the kiln as a dryer. The effects of this method on kiln operation have already been shown. It is expensive of fuel and hinders production.

Fuel Value in Clinker Heat

Now about the fuel value represented by the heat in the clinker. The temperature at

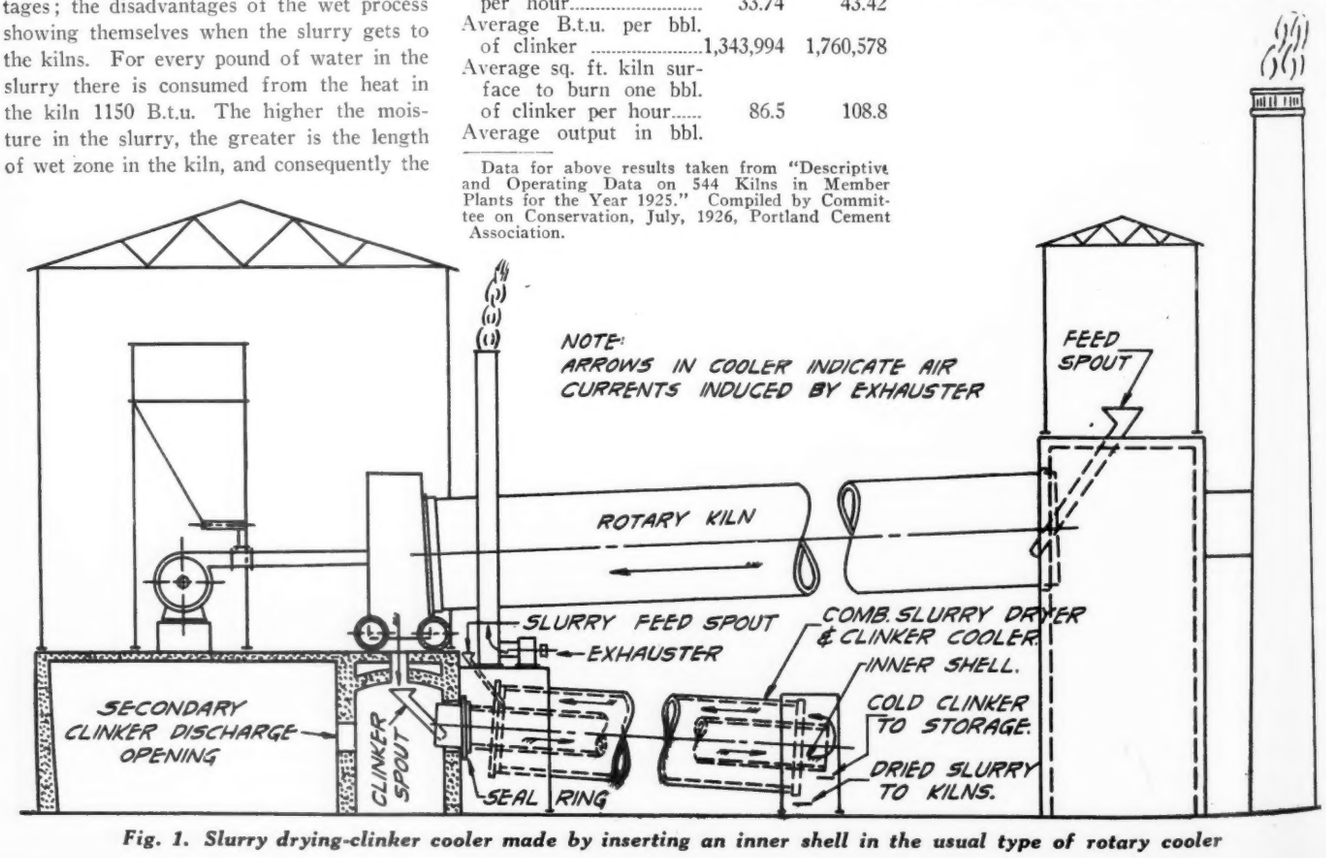


Fig. 1. Slurry drying-clinker cooler made by inserting an inner shell in the usual type of rotary cooler

which clinkering takes place varies of course according to the condition of the mix, but is usually about 2500 deg. F. to 3000 deg. F. The clinker leaves the kiln at or near 2100 deg. F. In cooling from 2000 to 300 deg. F. the clinker liberates 422 B.t.u. per lb.
[1 × (2000° F. — 300° F.) × 0.2478* = 422]

Assume a plant operating at 3000 bbl. daily capacity. The heat in the clinker that is discharged from the kiln each day is:

3000 × 376 × 422 = 476,016,000 B.t.u.

This is enough heat to evaporate 413,926 lb. of water daily at 100% thermal efficiency. Assuming that this plant runs its slurry at 34% water and uses 610 lb. of raw material per barrel of clinker, then the amount of water fed into the kilns daily is equal to 942,600 lb. In other words, there is enough heat in the clinker to drive off nearly 50% of the water in the slurry at 100% thermal efficiency.

If the heat in the clinker which at present nets but very little could be used to dry the slurry, the following advantages would result:

1. The fuel consumption per barrel of clinker will be reduced approximately 10%.
2. The kiln output will be increased about 12%.
3. The temperature of the stack gases will be considerably higher.
4. The clinker will be more rapidly and efficiently cooled.

Fig. 1 shows a new slurry drying clinker cooler which the writers believe to be practicable and very efficient thermally, and which can be made by inserting an inner shell in the present type of rotary cooler and controlling the flow of materials as shown in the drawing.

It is readily apparent what a saving of 10% would mean to the cement manufacturer. This saving coupled with that effected by an increase in production of 10 to 12% with practically no increase in power consumption or mechanical units would mean a considerable reduction in operating expense of a wet process plant.

The removal of the moisture from the slurry, which amounts to as much as 50% in some plants, greatly increases the temperature of the stack gases. This result is accomplished coincident with the reduction in fuel consumption; hence the efficiency of waste-heat boilers is greatly increased. On the other hand, where stack gas temperatures are now too low, the rise in temperature might be sufficient to warrant the installation of waste heat boilers.

Cooling the clinker has always been more or less of a problem in cement manufacture. The above method offers what is believed to be an ideal way of rapidly cooling clinker and at the same time making efficient use of the large amount of waste heat. A machine to do this would be simple in construction, thermally efficient, cheap in upkeep and low in first cost. It can be made from the coolers which are now in use.

There is good reason to believe that hot water could be used in the grinding process. With preheated water and the heat which is picked up by the slurry as a result of grinding friction, the efficiency of the slurry drying-clinker cooler would be greatly increased and a greater saving in fuel would be realized. Kiln efficiency would be increased if it were fed with hot slurry instead of warm, which is generally the case. Slurry in enclosed tanks does not cool off very rapidly during its travel from the grinding mills to the kilns.

Dryers somewhat of the construction above mentioned are obtaining thermal efficiencies of 70% to 75% regularly. The 30% to 25% of heat lost from the clinker through the efficiency of the dryer could be easily made up by preheating the grinding water. A slurry temperature of from 50 to 75 deg. C. would accomplish this result. There are many places in cement plants where the grinding water could be easily heated to the necessary point to obtain a slurry of this temperature, notably at the kiln stacks or boiler flues. Ability to operate with less water and the same slurry viscosity, due to the considerable decrease in viscosity of water upon being heated, might also result. Hot slurry operation is necessarily limited by the time the slurry is held in storage, which in some plants is much greater than others. There seems to be room for experiment with hot slurry both from the standpoint of viscosity and increased kiln efficiency.

If all of the slurry is run through the slurry drying-clinker cooler, the product would be a muddy, sticky substance, hard to handle, and no doubt would cause much trouble. This condition is easily overcome by feeding an amount of slurry which can be thoroughly dried and then conveying it as a dry substance to the feed end of the kiln, where it can be fed with the required amount of wet slurry. This would accomplish the same results as if the entire amount of kiln feed were first partially dried before entering the kiln.

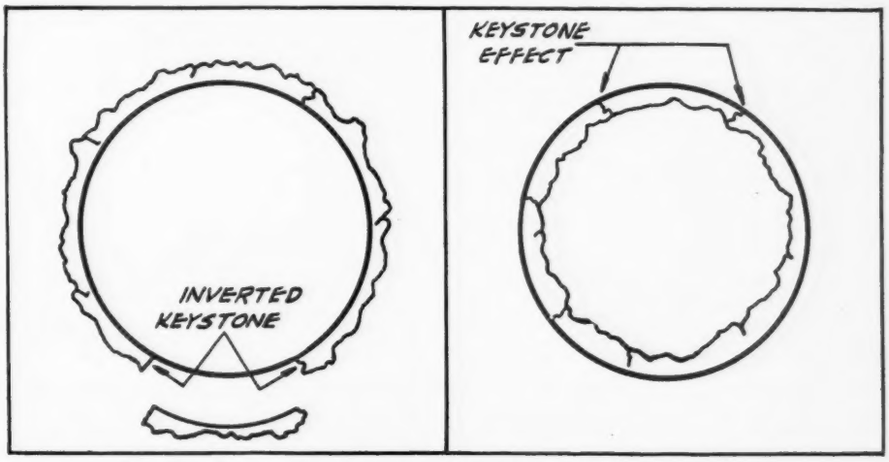


Fig. 2. Cross section of rotary kiln illustrating keystone effect

Laboratory Tests

The greatest disadvantage of such a process of drying slurry is the adhesive nature of slurry, which tends to make it stick to drying surfaces. Because of this the writers were led to build an experimental dryer-cooler to determine on a laboratory scale its practical possibilities.

The slurry was fed through a 2-in. pipe from a barrel employed as a storage tank. It was previously thinned down to insure against a possible plugging up of the pipe line or valve. It was not preheated, as the experiment was performed only to determine what would happen when the slurry came in contact with the heated inner shell. Thermal efficiencies were disregarded. Hand shoveling methods had to be resorted to in feeding the clinker, as this was the only means afforded of controlling the amount of clinker fed; hence the clinker had cooled considerably before reaching the dryer. They were fed at a dull red heat, however.

During the test the authors carefully observed the effects in the slurry compartment. The slurry was fed so as to fall at the bottom of the outside shell and was carried up by the lifters and dropped to the very hot inner shell. At that point there seemed to be an almost instantaneous conversion into steam of the moisture present in the slurry in contact with the hot shell surface. The contact surface of the slurry rapidly became dry, losing its adhering nature and the slurry fell off. After a two-hour test there was practically no thickness of slurry on the inner shell.

The Keystone Effect

The rapid drying of the cement slurry on its passage over the inner shell checks the adhesive nature of the slurry and thus the keystone effect shown in Fig. 2 is not possible. In this way there can be no great building up of dried slurry on the inside of the slurry chamber which would tend to act as an air insulator and prevent heat passage from the clinker chamber.

On the outer shell there was a gradual building up of slurry which soon stopped

*Mean specific heat.

the work of the small lifters and prevented a longer test. However, since the slurry is dried in the kiln, by analogy it can be said that it can be dried on the inner surface of the outside shell of a slurry drying-clinker cooler. The fact that slurry being dried under such conditions will build up to 6 and 8 in. of thickness necessitates the carrying out of an experiment on a plant sized scale with a machine of sufficient size. A machine of this type would have three drying surfaces and the induced fan draft could be controlled by a thermostat governing the speed of the fan motor so that the wet air and steam could be discharged very near 100 deg. C. A test of this device carried out on a plant-size scale is perhaps the only way of deciding its applicability.

New Cement Plant at Calais, France*

THE Sangrette works of the Societe des Ciments du Calais are situated four kilometers south of the city of Calais and connected with the port by rail. The raw materials employed for making cement are chalk of a particularly fine grain and a plastic clay. The wet process of cement making was adopted because of the soft nature of the material.

Cars of clay and chalk are dumped directly into a wash mill (delayeur) 9 m. in diameter. In a single operation chalk and clay are reduced to a thick mud. Raw grinding is finished in a tube mill with peripheral feed and central discharge. The slurry is ground so that only 2% remains on a 70-mesh screen.

From the tube mill the slurry with 35-40% of water is elevated by a high-speed rotary pump to the correction and air-agitation tanks. From these it flows by gravity to the reserve tanks which contain enough to keep the kiln in operation for about six days.

The compressed air is led into the tanks by pipes from which it escapes near the bottom. The bottom is slightly inclined.

The slurry is sent to the kiln by a high speed rotary pump from a sump which contains slurry enough to keep the kiln going several hours.

The rotary kiln has a diameter of 2 m. 50 (8 ft. 4 in.) and is 60 m. long (180 ft.) It has no enlarged zone. Nevertheless its output is high. The constructor's guarantee was for 140 (metric) tons but the kiln is easily able to produce 170 tons and has even reached 200 tons per day (about 1200 bbl.) Powdered coal is used for fuel.

Cars of coal coming to the plant are discharged over a large screen of perforated metal. The coal is picked up regularly by an oscillating shovel combined with a "Delta" impulse conveyor. An elevator and rubber belt stock the coal automatically, the reverse stock of 2000 tons being kept under cover. As the plant needs it, coal is withdrawn from storage, dried in a rotary dryer and ground in a "Centaure Compound" mill 1 m. 300 in diameter (51 in.) and 8 m. 300 long (28 ft.) It is sent to the kiln through a double distributor the speed of which is regulated by the kiln operator.

The cooler is of the classic rotary type and the dimensions are calculated to obtain a clinker free from the heat of the kiln. Space has been left at the end of the cooler to install an automatic control.

The clinker is slowly conveyed by a "Delta" conveyor to a bucket elevator 14 m. high. A belt conveyor and tripper distribute it in the storage shed which holds 8000 to 10,000 tons.

Finish grinding is carried on in a "Centaure Compound" mill 1 m. 800 (70-in.) in diameter and 10 m. (34 ft.) long. The product is conveyed to silos from which it is drawn to automatic sacking machines.

An analysis of the regular product is:

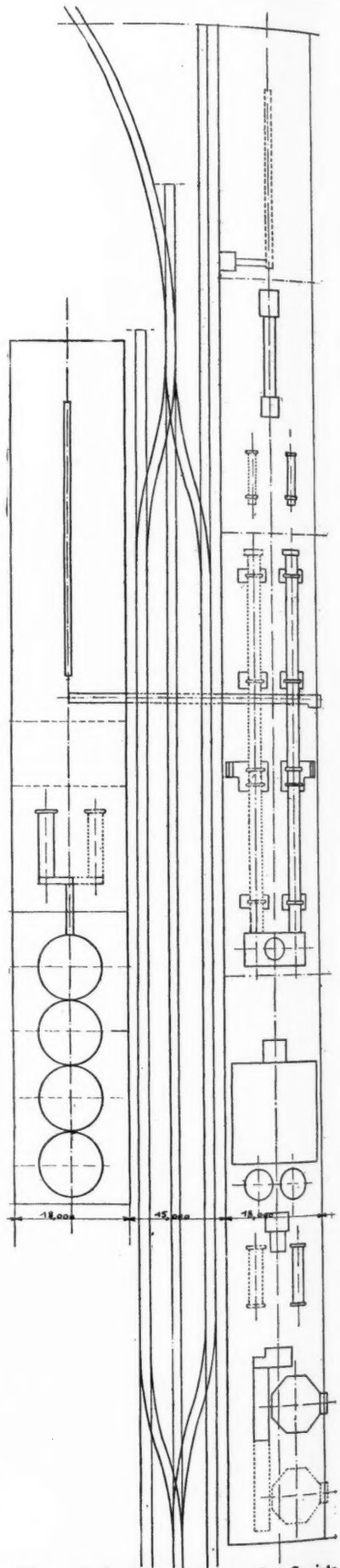
SiO_2 (soluble)	21.46
SiO_2 (insoluble)	0.40
Al_2O_3	6.68
CaO	64.38
Fe_2O_3	2.36
MgO	1.08
SO_3	1.56
Loss on ignition	1.40
Lost and undetermined (alkalis)	0.68
	100.00

*Abstracted from Revue des Materiaux de Construction, January, 1927.

New Oyster-Shell Cement Project in Texas

EQUIPMENT is being assembled at Palacios, Tex., by the Gulf Coast Shell and Cement Co. for the operation of a large plant for handling oyster shells for ballasting railroads and surfacing highways. Besides the immediate construction of eighteen barges, the plans of the company include cleaning out the channel into Palacios to a depth of 6 ft. and connecting it with the railroad, establishing loading machinery that will handle 1000 yd. a day, using 18 barges, deepening a channel into the Collegeport harbor 6 ft. deep and connecting it with the railroad there, building a harbor and turning basin there and a loading equipment that will handle 1000 yd. of shell per day.

The cost of the shell-handling plant will be approximately $150,000. The company, it is reported, also will construct a large cement manufacturing plant at some point in the Gulf coast region, adjacent to the shell banks. Officers of the company are: H. L. Meyer, J. E. Reed and Clyde Zerby, all of Houston, and A. E. Wickham.



Plan of the Sangrette works, Societe des Ciments du Calais

Two Notable English Contributions on the Manufacture and Testing of Cement*

[With the dissolution of the British Portland Cement Research Association, the British scientists have been quick to recognize that the future progress of the portland cement industry of that country was dependent entirely on private research. So it is not surprising that one of the most interesting features of the recent meeting of the London section of the Society of Chemical Industry were several papers on portland cement. Two of these, "Modern Portland Cement Manufacture," by S. Dickson, and "The Testing of Portland Cement," by R. H. Harry Stanger, are reprinted herewith.]

Modern Portland Cement Manufacture

By S. DICKSON

The British Standard Specification for portland cement states that the cement shall be manufactured by intimately mixing together calcareous and argillaceous or other silica- and alumina-bearing materials, burning them at a clinkering temperature, and grinding the resulting clinker so as to produce a cement capable of complying with this specification.

The reason for a description of this nature is that the raw materials from which portland cement is manufactured have very widely differing characteristics. Those used in the Thames and Medway districts are soft in character and are converted into slurry by a simple process of washing with water, whilst others, such as are found in the West Country, are hard stone and require the expenditure of considerable energy to bring them to the necessary degree of fineness.

Whatever the nature of the raw materials, they must be brought, by suitable means, to an extremely fine state of division to permit of the chemical combination of the constituent parts.

Manufacturing Steps

The name "slurry" is applied to the mixture of chalk, clay and water, and the preparation of slurry is carried out as follows: Measured quantities of chalk and clay are tipped into a wash mill, and water is added in such amount that the resultant slurry is of a consistency that can be pumped. The wash mill is usually an octagonal tank in which revolve stirring arms or ploughs, so arranged as to break up and thoroughly mix the materials. The process is continuous, the mixture passing through screens or sieves which retain the coarse pieces and allow the fine particles to pass on. The slurry may contain comparatively coarse particles, and to reduce these to a suitable fineness, wet-grinding mills are used. The slurry passes from the wet mills to mixers or storage tanks and is continually stirred to prevent segregation.

It is essential that the particles of chalk and clay are not only in an extremely fine state of division but that they shall be very intimately mixed and maintained in that condition until chemical combination is brought about by heat in the kiln.

Variations in the composition of the slurry occur from time to time, and this is due largely to the amount of water present in the raw materials.

Checking, by chemical analysis, enables corrections to be made by additions or variations in the proportion of chalk and clay. The storage tanks are sufficiently large to allow this to be done before the slurry goes to the kiln, to which it is pumped direct, and burnt to clinker, the clinker being ground in mills similar to those used for the wet slurry.

The rotary kiln is in general use in this country and usually yields a clinker of very high grade, thoroughly burnt, but not overburnt.

Up to this stage of manufacture there is little or no change from the practice of past years, with perhaps the exception of greater care in the adjustment of the mix and the control of that adjustment by better equipment and staffing of the chemical and testing laboratory.

Production of Rapid-Hardening Portland Cement

The advent of a competitor with portland cement has had a very marked effect on the manufacture. Aluminous cement has the property of hardening very rapidly and attains a high strength in a very short period. Cement of this nature is extremely valuable under certain circumstances such as road repairs in large cities. It has, however, been discovered that portland cement could be made to give similar results, and the manufacture of this quality of rapid-hardening portland cement is now in full swing. It has been stated by manufacturers that in the near future all cement made will have quick-hardening qualities.

It is an old saying that cement is made in the wash mill, and this is still true, but as regards only quality only: that is soundness, for without good, well mixed slurry, sound cement cannot be made.

Fine grinding of the clinker obtained from good slurry is the great advance that has taken place in the manufacture of portland cement in the last few years. But fine grinding of rotary-kiln clinker requires good grinding mills and time. Fine grinding is obtained with ball and tube mills when the material is not put through the mill at too great a speed, and therefore to obtain the same output, greater mill capacity is needed for the production of rapid-hardening cement. This is being obtained by the introduction of larger mills which combine both ball and tube mills in one machine.

Portland cement is now being manufactured and sold having a fineness, as indicated by the sieving test, of 1% residue on the 180 × 180-mesh sieve; it has rapid-hardening properties and very high strength and perfect freedom from unsoundness.

Mechanical strength is usually greater with cements having a high lime content, and rapid-hardening cements contain a high percentage of lime. The rapid hardening is probably due, however, more to the fine state of division of the cement than to its chemical composition.

Relation of Fine Grinding to Quick-Hardening

Rapid hardening, or the attainment of high strength in a short time, is an indication of the speed of the chemical combination of the cement with water; besides the chemical action there is also a mechanical one due to the increased covering power of the "flour" or fine particles of cement.

In a mixture of 1 part of cement to 3 parts of sand the amount of "flour" in the cement will have a very marked effect on the strength, apart from the actual strength of the cement itself. With a finely ground cement, each sand grain will be surrounded by fine cement in very close contact with itself and its neighbors, and density and adhesiveness will be increased. It is, therefore, necessary to know what quantity of "flour" is present in cement, more especially since these rapid-hardening portland cements have already passed beyond the limit of the sieve. In fact, the sieve is not now a measure of coarseness.

The amount of useful material in a given cement is probably only that which shows marked setting properties in, say, seven days, or some short period, and the determination of the proportion of active and inert ma-

*Reprinted from the *Jour. Soc. Chem. Ind.*, 45, 37, 310-15 (1926).

terial would give much more useful data as to the value of a cement.

For the determination of "flour" it has been found that air separators or flourometers have not given very satisfactory results. Elutriation, as distinct from air separation, seems to promise better results, as undoubtedly better control of the separation of the coarse particles can be secured by the use of a liquid. The liquid must, of course, be without action on portland cement, and itself be unaffected.

It is probably a matter for considerable research to determine what size particle can be called cement, and what greater size "core," and by core I mean inert non-setting clinker.

Testing Cement by Elutriation Method

Most elutriators require a large volume of liquid for their working, mainly because the finer particles are collected for examination. With portland cement, however, I confined myself to the determination of coarse particles, and I have constructed an eluatriator using white spirit, in small bulk, which seems to give useful results. The eluatriator consists of a device to maintain a constant head, and a glass apparatus in the shape of an elongated separator; this has a three-way tap fitted at the lower end, and to the top a glass jet. The rate of flow of the liquid is controlled by the size of the jet, and the height of the head and the apparatus can be standardized. The supply of liquid is maintained by the use of a small pump circulating the liquid from a lower tank to an upper one, the excess of liquid returning to the lower vessel by gravity through an overflow pipe. In the lower vessel, into which the "flour" removed by the liquid is carried, is a filter by which means the "flour" is removed and the clear liquid returned into circulation again.

The process is as follows: 20 g. of cement are washed into the elutriator with white spirit, the glass jet being removed during this procedure. The jet is replaced and the motor started. The liquid in the upper tank is now at a constant level or head, and on opening the three-way tap at the lower end the liquid forces its way through the cement collected in the narrow part of the elutriator. It is washed by the incoming stream and the small particles are carried upwards and away through the jet into the filter chamber. The end of the separation of the "flour" is seen by the formation of a clear zone at the upper end just below the jet. When this occurs the flow of liquid is stopped, and the coarse material collected by running the contents into a dish. The white spirit is removed and the core gently ignited to eliminate all spirit residue, and weighed. The complete operation occupies from 1 to 1½ hours, and requires very little attention.

The figures obtained on various cements by this apparatus and process are as follows:

	Residue on 180 × 180	Core
A	6.0%	51.0%
B	7.2%	49.5%
C	5.0%	43.0%
D	4.2%	36.1%
E	6.1%	48.0%
F	1.7%	42.6%
G	1.1%	40.0%
H	1.2%	25.0%
J	10.9%	47.5%
K	3.5%	36.4%
L	1.1%	24.8%

It is true that these figures do not give an estimation of the amount of active material in the samples tested, but it is interesting to note that the one with the smallest amount of residue is one of the rapid-hardening portland cements. To obtain this low residue it is obvious that a larger amount of truly active "flour" must have been produced at the same time, and it is the determination of active "flour" which must be the aim of experimenters.

It is desirable to grade the cement into different finenesses, and to do this more elutriators could be put in series, each, after the first, having larger dimensions than the preceding one. Research in this direction would add materially to the knowledge of the effect of fineness on the strength of portland cement.

The Testing of Portland Cement

By R. H. HARRY STANGER

IN the early days, that is, before the British Engineering Standards Association was formed, the number of specifications with which portland cement manufacturers had to contend was legion; every engineer insisted on his own ideas for the testing being carried out. In 1905 the first British Standard Specification was published and was accepted by every maker of repute as a standard of quality which had to be complied with. Since then there have been five revisions published—in 1907, 1910, 1915, 1920, and 1925.

In 1905 the permissible residue on the 180 by 180 mesh sieve was 22½%; now it is specified to be 10%. Actually, from records in my own laboratory, it is unusual to find a portland cement leaving a residue of more than 5% on the 180 sieve; and as Mr. Dickson has pointed out, in the case of rapid-hardening portland cements this is reduced to 1%.

This improvement in the fineness corresponds with an advance in strength. In 1905 the tensile strength of the 3:1 mortar briquettes was specified to be 120 lb. at 7 days and 225 lb. at 28 days after gaging. The strength required now is 325 lb. at 7 days, with an increase to 356 lb. at 28 days. Records show that these figures might well be appreciably higher, as in actual practice higher strengths are usually obtained.

Specification for Sand for Cement Testing

The sand used for cement testing has been standardized in every country. Here a variety of Leighton Buzzard sand has been adopted. The specification lays it down that this sand shall be of the white variety, and shall be thoroughly washed and dried. It must all pass through a sieve of 20 by 20 meshes per square inch and be retained on one of 30 by 30 meshes. In this connection it appears to me that the specification could be improved by insisting on the grains of sand being graded to intermediate sizes between the 20- and 30-mesh sieves. I feel sure that if this were done, even better and more uniform strengths would be obtained from the mortar briquettes.

Since one of the principal objects of testing is to ascertain whether a cement is sound or not, a special test for determining the soundness has always been included in every specification, and as the soundness of a cement can in actual practice only be proved after the course of time, these special tests are necessarily of an accelerated character. The two best known tests of this nature are the Faija "pat test" and the Le Chatelier expansion test, this latter having been incorporated into the British Standard Specification since the first issue in 1905.

Soundness Tests on Cements

The Faija pat test is carried out by subjecting a freshly gaged pat of the neat cement on a glass plate to a moist heat of 100 deg. F. (38 deg. C.) for some four hours and then immersing it in warm water maintained at 115 deg. F. (46 deg. C.) until 24 hours after gaging. A sound cement becomes quite hard after such a test and still adheres to the glass plate. An unsound cement will show signs of "blowing," cracking or buckling.

For the Le Chatelier test a short split cylindrical mold is used, having on either side of the split two parallel arms. In making the test the mold is placed on a small piece of glass and the neat cement paste is filled in, care being taken to keep the edges of the split together. After filling, the mold is covered with another piece of glass plate, placed in cold water, and left for 24 hours. The distance separating the points of the parallel arm is then measured and the mold placed in a cold water bath which is brought to boiling point in about 30 minutes and kept boiling for six hours. The distance between the points is then measured, the difference between the two readings being the expansion of the cement.

The British standard specification lays it down that this expansion must not exceed 10 mm. after the cement has been aerated for 24 hours, or 5 mm. after seven days' aeration. It has been suggested by some experimenters that the expansion should be measured as from the time of first immersing in the cold water, so that any expansion due to the first period could be included. While it is true that on rare occasions a cement is produced which shows an appre-

ciable expansion in the cold water, it is generally recognized that the vast majority of samples tested in this way do not expand during this part of the test. Probably the worst specimen of cement to come through my laboratory had an expansion of approximately 120 mm., whereas 10 mm. has been the maximum allowed since 1907, and it is rare for an English portland cement to fail in passing this test.

Specification for Standard Portland Cements

As regards the chemical composition of portland cement, the standard specification has, since 1910, been very consistent with one exception. Right from the commencement the specification has limited the content of magnesia to a maximum of 3%, and all portland cement manufactured in this country falls within this limiting figure. The 1925 revision, however, allows up to a maximum of 4% of magnesia. This increase was adopted to meet the wishes of the Indian manufacturers, who found difficulty in complying with the previous specifications in this respect. There is no doubt that too high a content of magnesia in the cement may have a deleterious effect on concretes, particularly when used in seawater construction, and when the concrete is porous. It was, however, felt that up to 4% could safely be permitted, and in this connection it is interesting to note that as much as 5% is allowed by some of the standard specifications issued on the Continent and in America.

There is one very important test which has been adopted as standard by nearly every other country except ourselves and the United States—namely, the compression test of the mortar. I believe that this test will eventually be used.

A difficulty which is always coming up is the effect of the human equation on the mechanical test results. In this country the quantity of water required for gaging is left to the discretion of the gager; the specification does endeavor to lay down the process of gaging and the tools to be used, but it can never assess the physical energy expended or standardize that quantity. Other countries have adopted mechanical means both for mixing the dry materials, sand and cement, and for filling the molds. This should, of course, produce more uniform results, although it is wonderful how consistently an expert gager will work. This question of mechanical filling of molds has been discussed recently amongst testers in this country, and it is quite possible that some such method will eventually be adopted as standard.

Discussion

Dr. Geoffrey Martin suggested that, other factors being constant, the rate of hardening was dependent upon the surface exposed by the cement particles. The larger the surface per pound of cement the more rapid the hardening. The reason was that setting came about as the result of interaction at the surface of the particles with the surrounding water. The cement absorbed water and the surface became covered with a growth of semi-gelatinous hydroxy-compounds, which interlocked and finally caused the aggregate of particles to set as a hard mass. The internal core of the particles was unchanged cement. Only the outer surface was attacked by the water. Consequently a finely ground cement exposing a large surface was more rapidly and more completely converted into the hydroxy-compounds than one not so completely finely ground. He suggested that the authors should extend their experiments by fractionally elutriating a cement in a stream of white spirit traveling at different and uniform speeds. To each speed there corresponded a particle of a definite size, which could be calculated from the viscosity, speed of flow and density of the elutriating liquid. On then gaging each of these accurately graded batches of cement with water in the usual way it would be possible to measure exactly the effect of increased surface upon the rapidity of hardening and strength of the resulting set cement. These experiments were projected by him some time ago, but owing to the premature dissolution of the British Portland Cement Research Association last year just as it was entering into its most productive phase as regards practical applications, he had not been able to carry them out up to date. The preliminary work done by air elutriation on sand had shown that it was possible to sort out powders into uniform grades of a fixed average diameter. He hoped to publish these results shortly.

Rotary Kiln Efficiency

Some of the conclusions reached as regards rotary kiln efficiency as the result of much research work by the British Portland Cement Research Association were as follows: (1) The ordinary rotary kiln is extremely inefficient as a thermal machine. Theoretically 100 tons of cement should be made by the expenditure of about 6.35 tons of standard coal (of 12,600 B.t.u. per lb.). At the present time the average coal consumption ranges around 33 tons per 100 tons of clinker, so that the efficiency is only about 19%. (2) No appreciable advance has been made in rotary kiln efficiency during the last 25 years. The kilns have been made larger, but a well run small rotary kiln of 25 years ago of, say, 100 ft. in length, consumed about the same amount of coal per 100 tons of clinker as the present-day giants of 250 ft. Both large and small kilns, when well run and properly dimensioned, burn from 28 to 33 tons of standard coal per 100 tons of clinker. In other words fuel economy is independent of the absolute dimensions of the kiln. This was quite contradictory to the statements made by the engineers of 25 years ago who, in endeavoring to persuade manufacturers to install large kilns, made predictions as regards the economy to be attained which, in the light of present-day experience, seemed almost comical. The fact of the matter was that no one understood the theory of cement burning. Almost all types of rotary kilns now in the market operated with about the same efficiency as regards fuel consumption for a given output. The data relating to exact tests on German, Danish, and British kilns of recent date were conclusive. Individual skill in working a kiln by the burners and the prevention of clinker rings and stoppages was of far greater influence in securing economy than the particular kind of kiln purchased. The advantages of large kilns were mechanical. (3) The mathematical law connecting the size of a kiln with its output has now been worked out from the theory of cement burning. It is now possible exactly to predict what output will be obtained from any rotary kiln of specified dimensions for a given fuel consumption. If this output is not obtained the reason is faulty working of the kiln by the burners or an obvious and radical defect of design.

This knowledge gave great power in correcting and controlling output. In one case recently he had pointed out to certain manufacturers that according to this law their kilns were working at about 80% below their theoretical output; they regarded this as incredible until the matter was put to the test, when the law was completely verified. Increasing the output beyond the theoretical amount resulted in underburnt clinker. In fact the "trial and error" period of the rotary kiln had now passed, and scientific exactness had been attained.

Design of Rotary Kilns

As regards kiln design the law provided a means of predicting from scientific theory the dimensions of the kiln necessary for any output from 1 ton per hour up to, say, 100 tons per hour.

(4) Within limits fuel economy is almost independent of the quantity of water in the entering slurry. This might at first seem surprising, but theory and practice conclusively agreed on this point. That is to say, if a kiln of sufficient length is charged with a slurry containing 40% of water and another of similar dimensions with a slurry containing, say, 10% of moisture, and if the output of each kiln is maintained the same, in each case the fuel consumption per 100 tons of clinker produced will be nearly the same. In other words reducing the amount of water in the slurry does not save much coal.

Much of the data published on this point was incorrect to such a degree that it almost appeared as though the results had been assumed as obvious.

(5) As regards the exact causes of the inefficiency of the rotary kiln, these were now known exactly, but owing to the confidential nature of the information this subject cannot be discussed publicly. As the result of this work new types of kiln are being designed with an output so large and a fuel consumption so low as to cause sur-

prise, if not incredulity, among those who at the present time consider that we have reached the zenith of economy in cement production.

It was remarkable how the British cement manufacturers of today failed to avail themselves of the many profitable discoveries which had been made recently. It would suffice to mention that at the present time about 4,000,000 tons of cement were produced annually in Great Britain and sold for £11,600,000. The cost of the British Portland Cement Research Association had been £5000 annually, of which the government paid half. So that the cost of the research carried by the trade was only 1.20 of a penny per ton of cement sold at 58s., and at a profit of over 20s. per ton. The fact that even this trifling cost proved too much for a prosperous trade to maintain indicated in an ominous manner their frame of mind towards progress. It was significant that the cement trade celebrated the centenary of the discovery of portland cement by abolishing their Research Association, and that not a single piece of research work nor a single advance of importance has been made by an Englishman during the last 25 years. Such progress as had been made had come to us from America, Germany, Denmark, or France.

Rapid-Hardening Portland vs. Alumina Cements

Mr. D. B. Butler said that he had recently examined many samples of British and Continental rapid-hardening portland cement, and so far as he could see, there was very little to choose between this and aluminous cement as regards early attainment of strength. As an instance, a sample of English rapid-hardening portland cement recently received had developed at 1, 3, and 7 days a resistance to tensile stress of 437, 595, and 637 lb. respectively, with the 3:1 sand-cement mortar. With regard to the elutriation method of testing, he asked if Mr. Stanger always obtained uniformly concordant results with it; with the Goreham flourometer, an air separator on a similar principle, which he had thoroughly tested some ten to fifteen years ago, he could never get concordant results. What would be the result with the elutriation apparatus described if the cement was in the least degree air-set? Would there not be a tendency for the air-set particles to be left behind and weighed as unreduced clinker? He had strenuously opposed the Chatelier boiling test, when it had first been adopted in the British Standard Specification of 1904, on the ground that it was needlessly severe, and too frequently condemned a perfectly good cement; the fact that practically none of the cement manufactured thirty years ago would withstand boiling water was a strong argument in favor of this contention, since the cements then used for large and important engineering structures had stood perfectly well, without any signs of failure. On the other hand, the adoption of the Chatelier boiling test had proved "a blessing in disguise," for to enable their cement to pass this test, manufacturers were compelled to adopt more efficient methods of manufacture, more especially finer grinding of raw materials in the first stage of mechanical mixture, and this, among other things, had resulted in an all-round improvement in the quality of English portland cement. It might be that, in practice, concrete was more often subjected to compression than to tension, but tensile tests were easily applied, and gave a very good indication of the cementitious value of the cement. If compression tests were adopted as a standard it would practically rule out the testing of cement on the job, on account of the expensive machines and appliances required, compared with the simple tensile tests, apart from the necessary skill and experience required.

The authors, replying to the discussion, sympathized with Dr. Martin over the dissolution of the Portland Cement Research Association, which had undoubtedly carried out a great deal of important research work. Air-separation, as mentioned by Mr. Butler, had not proved entirely satisfactory for portland cement, but with liquid elutriation it was well known that finely powdered material would be divided up in a stream traveling at different and uniform speeds, and their experiments were still being carried out to determine the real fineness divisions of different cements. The experiments with the elutriator described by Mr. Dickson, showed that the variation in two determinations on the same cement was less than 1%, a result which was not possible with the usual air flourometer. As regards the elutriation of an air-set cement, it would be necessary first of all to remove any lumps before attempting to determine the proportions of flour and core. While agreeing with Mr. Butler that there was not very much difference between the tensile strength of aluminous and rapid-hardening portland cements, it was necessary to point out that under compression the aluminous cement attained a far greater strength at the early periods after gaging than did the rapid-hardening portland cements.

Portland Cement Stucco Investigations at Bureau of Standards

DURING the past few years there has been a rapid and widespread growth in the use of stucco for the exterior finish of various types of buildings. The Bureau of Standards, in co-operation with interested associations and manufacturers, has carried out a number of investigations for the improvement of stucco construction. Bureau of Standards Circular No. 311 summarizes briefly these studies and outlines the essential factors to be considered for satisfactory stucco work. Several types of construction widely used for stucco are described and illustrations are given of the details of good design. The requirements of the commonly used material are specified and methods are given for proportioning, mixing and applying the mortar. Several of the finish treatments are described and illustrated and some suggestions are given for the repair and painting of stucco.

National Builders' Supply Association Protests Cement Imports

THE following resolution was passed at the annual convention of the National Builders' Supply Association at Cincinnati, February 26:

WHEREAS, more than 10,000,000 bbl. of foreign portland cement have been imported, duty free, into the United States since January 1, 1923, of which approximately 4,000,000 bbl. were brought in during 1926; and

WHEREAS, the wages paid for the manufacture of the foreign cement and the wages paid for machinery, tools, electrical supplies, textiles, belting, etc., incidental to the manufacture of foreign cement are about one-fifth of the wages paid by manufacturers of cement and incidentals in the United States; and

WHEREAS, these importations represent a loss to American industries of more than $32,000,000, which money has left the country, weakening the American buying power to the detriment of the national prosperity, jeopardizing employment, wages, investment returns and the high American standard of living; and

WHEREAS, the building industries are among the first to feel the affects of business depression; and

WHEREAS, the Congress of the United States now has before it a concurrent resolution by Congressman Wood of Indiana, expressing the sense of Congress "that American materials should be specified in calling for bids on government construction; therefore be it

RESOLVED, by the National Builders' Supply Association in annual convention:

1. That public moneys should not be expended for the purchase of foreign cement to be used in roads and other public improvements to the detriment of American industries and tax-payers;
2. That this association, through its executive officers and individual members exert every proper effort to impress upon their national, state, county and municipal legislators and officials the good public policy of encouraging in every way the purchase of American-made products which come into competition with foreign-made products;
3. That this association heartily endorse and urge the prompt adoption by Congress of the resolution of Mr. Wood of Indiana above-mentioned; and
4. That all sectional associations be urged to adopt and publish a resolution similar to that adopted by the New England Builders' Supply Association; and be it further

RESOLVED, that copies of these resolutions be forwarded to all governors, United States senators and members of Congress.

Similar resolutions were recently adopted by the New England Builders' Supply Association at its annual convention, as noted in ROCK PRODUCTS of March 5.

Sand-Lime Brick Production and Shipments in February

THE following data are compiled from reports received direct from 31 producers of sand-lime brick located in various parts of the United States and Canada. The number of plants reporting is 3 more than those furnishing statistics for the January estimate published in the February 19 issue. The statistics below may be regarded as representative of the entire industry, the reporting plants having over two-thirds the production capacity in the United States and Canada.

Production showed improvement in February but is still low, building activities apparently not yet being completely under way. Several of the producers also have not yet finished overhauling their plants. Shipments in the past month were over 30% above the January figures. Examination of the statistics on stocks shows a decline about equal to the increase in shipments, so it can be assumed that the larger part of the orders were filled from stocks on hand. Unfilled orders declined considerably, indicating that new orders were as yet slow in coming in. Prices in February were slightly higher.

The following are the average prices received for sand-lime brick in February:

Shipping Point	Plant Price	Delivered
Detroit, Mich.	14.50	17.50
Lake Helen, Fla.	9.00@15.00	.....
Albany, Ga.	10.50	.....
Hummelstown, Penn.	11.00	.....
Madison, Wis.	12.00	13.00
Michigan City, Ind.	11.00	.....
Winnipeg, Manitoba	.....	14.00
Detroit, Mich.	12.00	15.20
Buffalo, N. Y.	12.25	16.00
Lakeland, Fla.	10.50	14.00
Atlantic City, N. J.	14.00	.....
Woburn, Mass.	13.50	.....
Flint, Mich.	12.00	.....
Hartford, Conn.	14.00	.....
Detroit, Mich.	13.50	16.00
Menominee, Mich.	11.00@12.00	14.50
Detroit, Mich.	.....	16.88
Detroit, Mich.	.....	17.50
Toronto, Ont.	11.50	*14.50
Toronto, Ont.	13.00	15.00
Toronto, Ont.	†11.75	†14.25
Syracuse, N. Y.	18.00	20.00
Rochester, N. Y.	.....	19.75
Milwaukee, Wis.	.....	13.00
Jackson, Mich.	12.25	.....

*50c tax extra. †Ex. tax.

The following statistics are compiled from data received direct from 31 producers of sand-lime brick in the United States and Canada:

Statistics for January and February, 1927

	January*	February†
Production	8,307,000	9,577,000
Shipments (rail)	3,939,000	5,185,000
Shipments (truck)	5,438,000	6,418,000
Stocks	17,032,000	13,215,000
Unfilled orders	17,908,000	12,580,000

*30 plants reporting. Revised to include 2 plants not furnishing January data previously.

†Incomplete, 5 plants not furnishing data on stocks and 12 plants not giving unfilled orders.

Weather conditions in many parts of the country appear quite favorable for an earlier start in building operations and many producers have started to increase production for the expected demand. However, in certain localities, notably Florida, poor business has forced a decline in building. One Florida producer writes: "Dullest period in 22 years. The world held a carnival in Florida last year and we are now resting a bit before resuming a normal development again. Every person here, however, has an abiding faith that Florida will continue its healthy stride of progress in due course; and this faith is based on a knowledge of the wealth of soil, climate and people which the state possesses." If we consider California as an example, the producer may be right in his opinion.

German Specifications for Sand-Lime Brick

THE work on the official German specifications for sand-lime brick (DIN 106) has been completed, according to the *Tonindustrie-Zeitung*. The following definition is given: Sand-lime brick are masonry units composed of silica sand and lime, mixed thoroughly and pressed into molds, in which they are allowed to harden under steam pressure. Sand-lime brick should conform to the following requirements:

Shape. Sand-lime brick must have the shape of a body with rectangular surfaces. The usual dimensions (standard size) shall be: length 25 cm., width 12 cm. and thickness 6.5 cm. Variations in length, width and height up to 2 mm. are permissible. (The standard German brick in usual American measurements is about 10 in. losg, 4¾ in. wide and almost 2⅝ in. thick.)

Compressive Strength. Sand-lime brick dried in air shall have a compressive strength not less than 150 kg. per sq. cm. (2130 lb. per sq. in.). Brick whose strength falls below 150 kg. per sq. cm. shall not be designated as a sand-lime brick.

The compressive strength shall be obtained as an average on 10 samples of one kind, tested in the following manner: the brick are halved perpendicular to their length and the halves joined with cement mortar to form cubes, whose surfaces are likewise capped with cement mortar. Sufficient time shall be permitted to elapse to allow hardening of the joints and cappings. No specimen in a sand-lime brick series shall have a strength below 120 kg. per sq. cm. (1700 lb. per sq. in.).

Absorption. Absorption shall be not less than 10% by weight. It shall be determined as follows: At least five specimens shall be dried to constant weight and then immersed in water until no further gain in weight is recorded.

Resistance to Frost Action. Sand-lime brick shall be resistant to frost action, i.e. no spalling shall be observed in the prescribed tests. Ten specimens are immersed in water, then placed in a sealed chamber of not less than ½ cu. m., where they are subjected 25 times to freezing at at least —4 deg. C. and for four hours allowed to thaw out, each time in water at room temperature.

Supplementary Data. The requirements of compressive strength place the sand-lime brick on a par with first grade brick. These requirements permit a stress of 10 kg. per sq. cm. (142 lb. per sq. in.) in ordinary masonry.

Sand-lime brick of dimensions larger or smaller than those here given shall come under these specifications if they otherwise satisfy the requirements set forth here.

Rubber Stamps Approved for Designating Brick

ONE of the ways that American sand-lime and clay brick manufacturers have hoped to curb importations of these building materials is by a regulation which requires each brick to bear a label showing its origin. Manufacturers in Canada are trying the same device, but Yankee ingenuity seems to have solved the problem at a reasonable cost.

"Made in U. S. A.," which has to be placed on all bricks exported from this country to Canada, may be applied by a rubber stamp, according to the Department of Commerce.

The full text of the announcement follows:

"The mark of origin required on building brick imported into Canada may be applied, by means of an indelible rubber stamp, to any one of six sides of brick, except the glazed surface, and may read as follows: 'Made in U. S. A.,' or the name of the company, city and state may be used. The use of paper stickers is not permitted. From October 15, 1926, imported building brick must be marked with an indication of the country of origin."

Use of X-Radiations in Study of Limes

ANOTHER interesting commercial application of X-rays is that of the study of limes and limestones, a development which will be described by Dr. Marie Farnsworth, of New York University, during the lime symposium to be held at the spring meeting of the American Chemical Society at Richmond, Va.

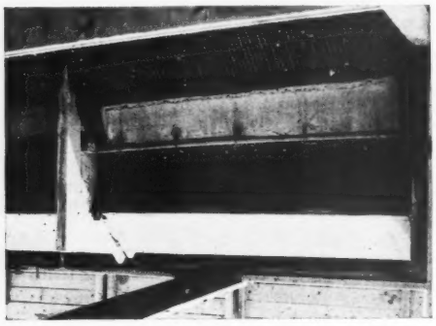
It is a common experience that two limestones from different sources but having approximately the same composition will yield limes of totally different physical characteristics and that other stones of widely differing composition may yield limes of very similar properties. Some hydrated lime, for example, when made into a putty will spread quite smoothly and without pull under the trowel, while others of the same composition work tough and harsh. Miss Farnsworth will describe the use of X-rays in the study of commercial limes and stones and will offer an explanation of some of these differences.

The symposium will include twenty other papers on problems connected with lime manufacture, properties and uses.

Hints and Helps for Superintendents

Baffle on a Gravity Screen

WHERE sand and gravel or crushed stone is screened over a gravity screen it is usually necessary to provide some way of checking the flow of the material. The screen has to be set at a certain angle in order for the material to start. After it gets in motion it tends to accelerate its speed. A swinging baffle plate, like that shown in the cut is the best way of checking the flow and to some extent in equalizing the flow over the screen. Any unusual rush of feed will be held back by the baffle and then flow out from under it in a thin stream.



Swinging baffle plate equalizes flow of material over screen

This baffle is made of a piece of old belting of good weight. It is supported by rings of heavy wire from a 1-in. pipe that is set into the sides of the screen frame.

Using a Self-Driven Car to Shift Railway Cars

THE cars employed by the centrally controlled electric haulage system in use in many quarries are of the self-driven type, in that each car has its own motor. Generally they are given no service but that of running between the quarry and the plant, but they may be put to other uses as the accompanying cut shows.

By having the third rail of this system laid in the railroad tracks of the plant any car may be used for shifting railroad cars just as a dinkey or gasoline locomotive would shift them. The man in the tower, of course, controls the movement of the car, and this is analogous to the practice in modern railroad yards where the switching of cars in making up trains is handled from a central control tower through an elaborate system. The centrally controlled electric system is in use at several large quarries.

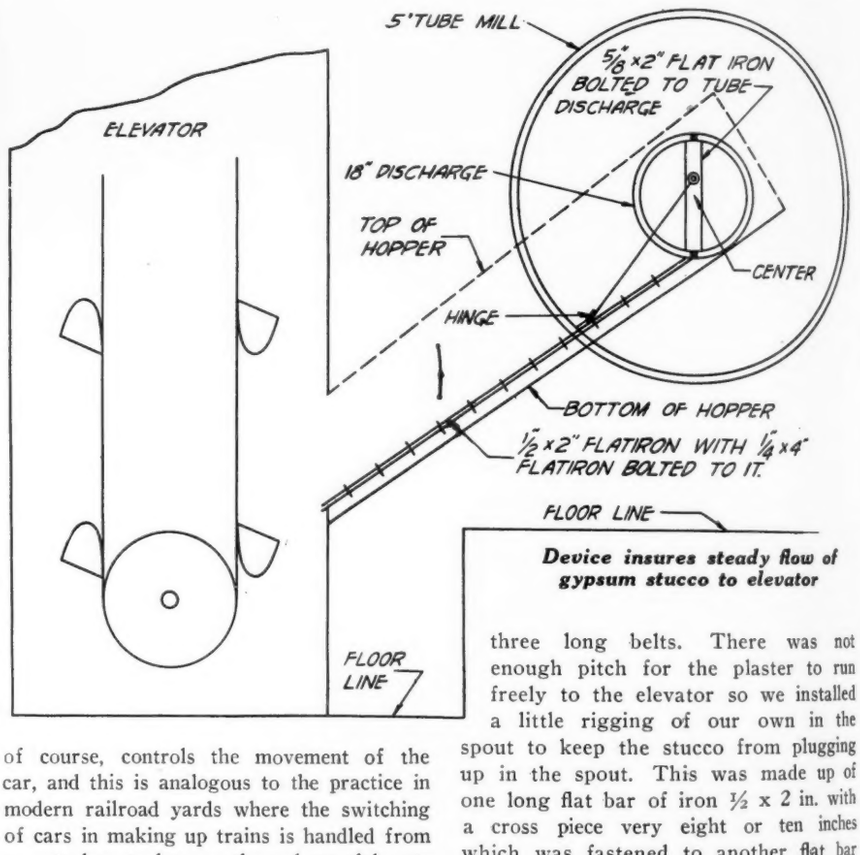
Standard-gage self-driven quarry car substitutes for shift locomotive on plant sidings

Preventing Gypsum Stucco from Choking the Chute

By JOSEPH F. STRABLE

Superintendent, Ebsary Gypsum Co., Caledonia, N. Y.

WHEN installing a tube-mill we found no way of driving a screw or belt conveyor to deliver the stucco from the tube-mill to elevator without a counter shaft and two or three long belts. There was not enough pitch for the plaster to run freely to the elevator so we installed a little rigging of our own in the spout to keep the stucco from plugging up in the spout. This was made up of one long flat bar of iron ½ x 2 in. with a cross piece very eight or ten inches which was fastened to another flat bar with a hinge. The flat bar on the other end was fastened to another bar across the discharge end of tube-mill about two inches oc center so as to keep a constant up and down movement of the long (½ x 2 in.) flat bar in the bottom, of the square spout leading to the elevator.



Device insures steady flow of gypsum stucco to elevator

The small cross bars (¼x4 in.) fastened to the long flat bar (½x2 in.) when drawn through the lodged stucco on its upward motion frees the stucco and causes it to flow forward. The downward motion of the bar keeps the stucco moving slowly toward the elevator.

We find this arrangement works very satisfactorily with what pitch we are able to give the spout. The entire arrangement is a very simple affair and seems too simple to mention, but it has saved us a lot of work and money in shafting, belts, etc., and is something I have never seen used elsewhere.

Blasting of Hanging Ore Columns in Chutes and Drawing Raises

ORE or rock from stopes in mines is generally dumped or drawn into chutes or raises through which it passes by gravity to the haulage levels, states the Bureau of Mines, Department of Commerce, which has conducted a study of the subject. Occasionally, and under some conditions quite frequently, the ore in a chute will wedge or hang and refuse to run. This hanging of the ore may be due to the packing of damp or clayey material, to boulders forming an arch, or to loose lagging or other timber becoming lodged in the chute.

In drawing material from a loading chute it is drawn out a car at a time, and the intermittent flow of the material increases its tendency to hang. When the obstruction in the chute is near or at the loading gate, the chute pullers start the ore by punching it with iron bars inserted through openings in the chute gate. When the obstruction is beyond reach of the bars, other means of starting the ore must be used.

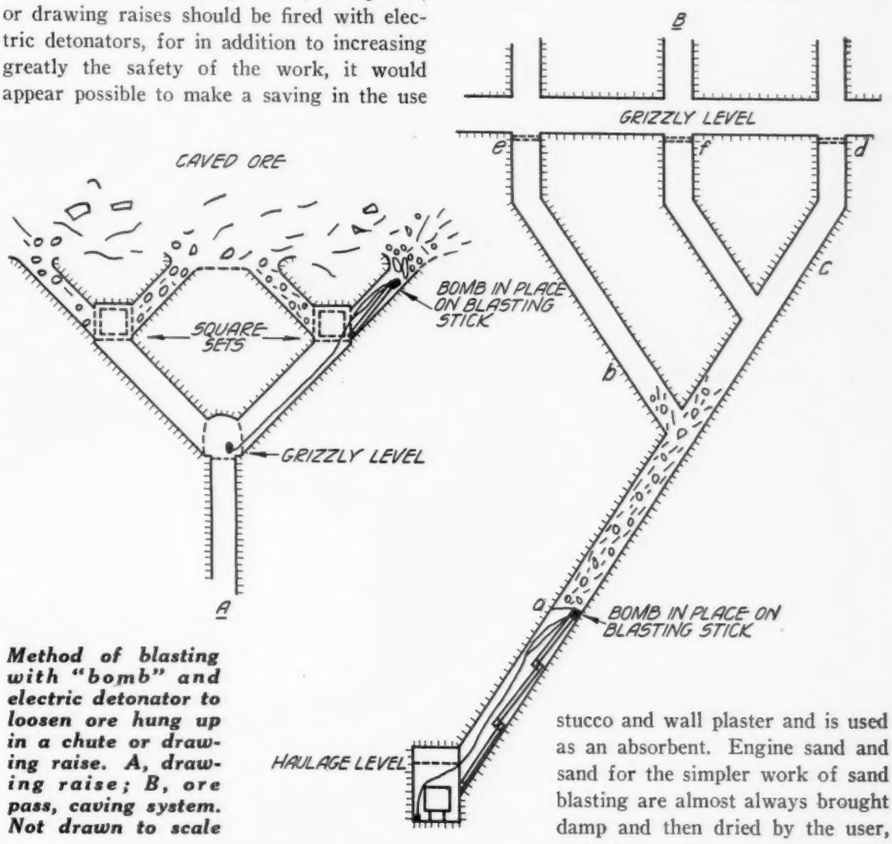
In some cases, the material may be started by pounding the chute timbers or by punching it with a bar inserted through a hole in the chute lining. Special methods such as shaking a chain left hanging in the chute are used also.

In cases where the pass or chute runs through solid rock, the hung-up material must be blasted or started from the top. If running water into the top does not start the material moving, a bundle of cartridges is detonated under the obstruction in the chute or raise.

This bundle of cartridges is known as a comb and is made by placing two to seven cartridges side by side and tying one end with a piece of stout twine. After the bundle is tied the middle cartridge is made into a primer by inserting a detonator in the end of the cartridge.

The results of a study made of the blasting of hanging ore columns in chutes and drawing raises by E. D. Gardner, superintendent of the Southwest Experiment Station of the Bureau of Mines, Tucson, Ariz., are summarized as follows:

All blasts in hanging chutes, ore passes, or drawing raises should be fired with electric detonators, for in addition to increasing greatly the safety of the work, it would appear possible to make a saving in the use of explosive, as bombs can be placed to the best advantage when the blasters are not made nervous from handling a charge containing a lighted fuse. The fire hazard is greater when fuse is used for blasting in timbered chutes than if the charges are detonated electrically. Firing bombs by electric detonators reduces the smoke.



Method of blasting with "bomb" and electric detonator to loosen ore hung up in a chute or drawing raise. A, drawing raise; B, ore pass, caving system. Not drawn to scale

Selling the idea of "bone dry" sand

Sand Company Sells "Bone Dry" Sand

EVERY sand producer who conducts a retail business sells a certain amount of sand which must be dried before use. This sand goes into some sorts of ready-mixed stucco and wall plaster and is used as an absorbent. Engine sand and sand for the simpler work of sand blasting are almost always brought damp and then dried by the user, and these often run into fairly large tonnages.

The consumer would often prefer to buy his sand already dried and to supply such a demand the Pratt Building Material Co., of San Francisco, which is one of the large sand producers of the Pacific coast, has erected the plant shown in the accompanying picture.

The sand is received at this plant from trucks and elevated to a hopper at the top of the plant. It is fed from this hopper to a cylindrical dryer which is oil heated and then elevated to a bin from which it is sacked or delivered in bulk, as the consumer desires.

A Use for Old Powder Cans

By PETER COMALLI
Superintendent, Lee Lime Corp.,
Lee, Mass.

WE purchase from the Hercules Power Co. black powder which comes in 25-lb. cans. After the top has been taken off and the powder removed, by putting a small hole on each side of the can near the top and using a wire for a handle, I find it makes an efficient pail for carrying mortar and one which can be used in places where ordinary pails are too large for convenience.

Portland Cement Output in February

Shipments Show Marked Increase—Production Declines—Stocks Establish New High Record

FEBRUARY shipments of portland cement show an increase of nearly 13% as compared with January, 1927, and an increase of nearly 16% as compared with February a year ago, according to the Bureau of Mines, Department of Commerce. February production shows a decrease of 890,000 bbl. as compared with the production in January, 1927, due largely to the short month, and a decrease of nearly 5% as compared with February, 1926.

Portland cement stocks are greater than at the end of any other month and are over 5% in excess of the stocks at the end of February, 1926.

These statistics, prepared by the Division of Mineral Resources and Statistics of the Bureau of Mines, are compiled from reports for February, 1927, received direct from all manufacturing plants except three, for which estimates were necessary on account of lack of returns.

Clinker Stocks

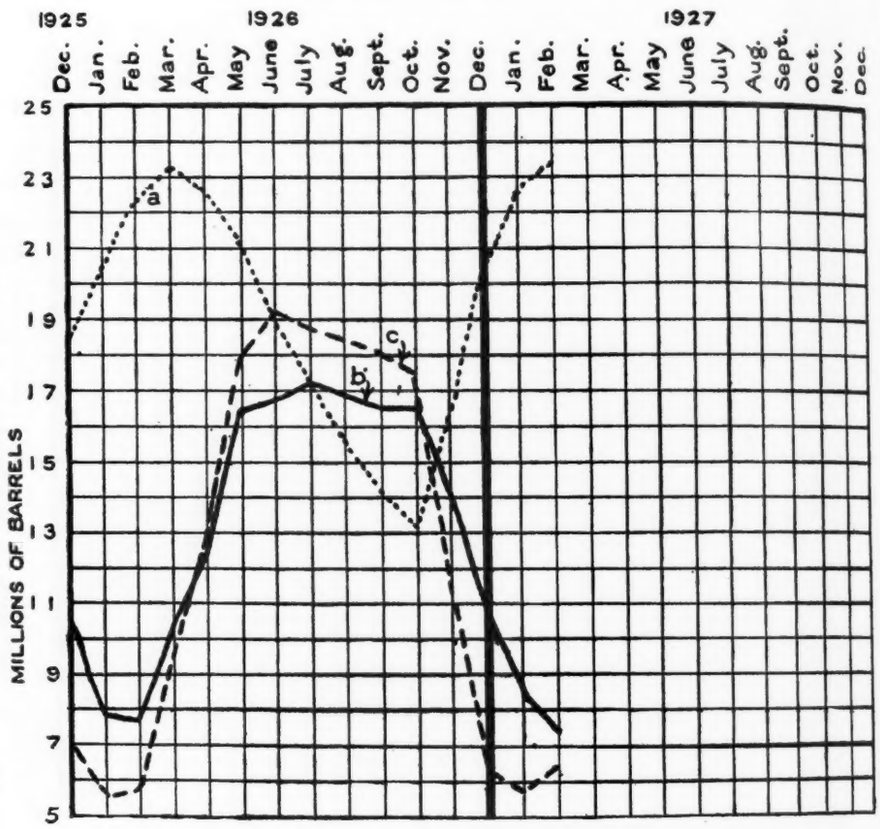
Stocks of clinker, or unground cement, at the mills at the end of February, 1927, amounted to about 12,082,000 bbl. compared with 9,989,000 bbl. (revised) at the beginning of the month.

ESTIMATED CLINKER (UNGROUND CEMENT) AT THE MILLS AT END OF EACH MONTH, 1926 AND 1927

Month	1926	1927
January	9,074,000	*9,989,000
February	10,931,000	12,082,000
March	12,290,000	.....
April	12,967,000	.....
May	11,695,000	.....
June	10,144,000	.....
July	8,604,000	.....
August	7,362,000	.....
September	6,112,000	.....
October	5,370,000	.....
November	5,748,000	.....
December	7,799,000	.....

*Revised.

MONTHLY FLUCTUATION IN PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT



(a) Stocks of finished portland cement at factories. (b) Production of finished portland cement. (c) Shipments of finished portland cement from factories

Distribution of Cement

The following figures show shipments from portland cement mills distributed the states to which cement was shipped during December, 1925 and 1926, and January, 1926 and 1927.

PORTLAND CEMENT SHIPPED FROM MILLS INTO STATES IN DECEMBER, 1925 AND 1926, AND JANUARY, 1926 AND 1927, IN BARRELS*

Shipped to—	1925—Dec.—	1926	1926—Jan.—	1927
Alabama	108,906	117,426	129,291	132,569
Alaska	132	297	165	.....
Arizona	61,646	39,536	38,869	54,088
Arkansas	43,281	42,245	46,708	46,014
California	938,721	901,526	931,238	998,230
Colorado	30,872	31,711	29,203	28,050
Connecticut	56,260	52,141	†40,300	34,587
Delaware	13,680	6,528	†9,019	11,170
District of Columbia	57,119	64,457	†35,304	50,552
Florida	439,786	317,402	483,824	283,031
Georgia	69,046	110,139	80,129	119,770
Hawaii	20,735	25,732	10,757	22,491
Idaho	15,993	13,199	19,198	15,085
Illinois	407,808	446,515	323,947	301,829
Indiana	114,856	108,771	85,724	74,589
Iowa	41,325	37,153	28,439	38,157
Kansas	87,368	88,010	56,598	68,122
Kentucky	63,382	62,172	35,560	42,851
Louisiana	74,464	89,843	65,695	116,633
Maine	7,028	6,255	20,310	6,295
Maryland	85,377	135,181	†85,495	135,015
Massachusetts	133,365	72,231	†101,212	70,354
Michigan	302,889	292,167	222,061	258,848
Minnesota	62,943	40,916	66,063	41,396
Mississippi	34,740	60,858	44,140	51,325
Missouri	207,230	152,647	137,343	113,581
Montana	7,382	6,455	9,716	7,261
Nebraska	34,633	26,933	23,788	22,675
Nevada	4,015	3,150	2,508	2,724
New Hampshire	22,586	18,340	17,081	16,172
New Jersey	329,054	255,744	†257,544	277,489
New Mexico	10,258	13,639	† 12,019	12,503
New York	889,639	788,046	†592,584	697,992
North Carolina	152,699	183,912	81,764	141,582
North Dakota	2,474	2,439	3,338	3,575
Ohio	339,030	312,336	220,728	226,786
Oklahoma	148,354	120,560	101,087	164,266
Oregon	46,531	47,637	53,995	35,715
Pennsylvania	597,328	469,376	†423,443	363,607
Porto Rico	.....	13,250	.....	2,550
Rhode Island	26,721	19,813	†18,409	19,352
South Carolina	54,545	31,523	44,723	42,537
South Dakota	6,379	3,625	6,413	5,094
Tennessee	80,322	82,556	66,379	86,485
Texas	284,061	303,770	270,231	362,004
Utah	21,135	12,944	10,655	13,356
Vermont	4,066	3,844	†2,072	5,606
Virginia	72,698	61,351	61,645	62,199
Washington	82,364	90,856	72,393	104,608
West Virginia	63,066	63,680	39,983	47,871
Wisconsin	77,100	95,776	60,400	76,148
Wyoming	7,968	7,430	5,797	5,972
Unspecified	8,140	396	†17,254	23,808
	6,851,500	6,354,439	†5,602,541	5,894,569
Foreign countries	65,500	77,561	71,459	73,431
Total shipped from cement plants	6,917,000	6,432,000	5,674,000	†5,968,000

*Includes estimated distribution of shipments from three plants in December, 1925, and January, 1927; from four plants in January, 1926, and from five plants in December, 1926.

†Revised.

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY DISTRICTS, IN FEBRUARY, 1926 AND 1927, AND STOCKS IN JANUARY, 1927

Commercial district	Production 1926—Feb.—1927		Shipments 1926—Feb.—1927		Stocks at end of 1926—Feb.—1927		Stocks at end of Jan. 1927*
East'n Penn., N.J. & Md.	2,447,000	2,353,000	1,137,000	1,708,000	5,115,000	5,761,000	5,116,000
New York	288,000	229,000	145,000	215,000	1,590,000	1,452,000	1,438,000
Ohio, W. Penn. & W. Va.	739,000	865,000	402,000	543,000	2,792,000	2,942,000	2,620,000
Michigan	288,000	263,000	237,000	334,000	1,947,000	2,021,000	2,093,000
Wis., Ill., Ind. & Ky.	775,000	450,000	649,000	652,000	3,700,000	3,239,000	3,441,000
Va., Tenn., Ala. & Ga.	1,029,000	1,020,000	937,000	992,000	1,058,000	1,195,000	1,167,000
East'n Mo., Iowa, Minn. & S. Dak.	483,000	404,000	396,000	362,000	3,066,000	3,241,000	3,199,000
W. Mo., Neb., Kan. & Okla.	361,000	236,000	518,000	527,000	1,399,000	1,556,000	1,847,000
Texas	393,000	396,000	400,000	382,000	488,000	475,000	461,000
Colo., Mont. & Utah	70,000	65,000	106,000	101,000	357,000	482,000	518,000
California	743,000	888,000	765,000	736,000	507,000	704,000	551,000
Ore. & Wash.	115,000	199,000	128,000	174,000	366,000	488,000	463,000
	7,731,000	7,368,000	5,820,000	6,726,000	22,385,000	23,556,000	22,914,000

*Revised.

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1926 AND 1927

Month	Production 1926	Production 1927	Shipments 1926	Shipments 1927	Stocks at end of month 1926	Stocks at end of month 1927
January	7,887,000	*8,258,000	5,674,000	*5,968,000	20,582,000	*22,914,000
February	7,731,000	7,368,000	5,820,000	6,726,000	22,385,000	23,556,000
March	10,390,000	.....	9,539.000	.....	23,236,000	.....
First quarter	26,008,000	.....	21,033,000	.....	.....	.....
April	12,440,000	.....	21,965,000	.....	22,710,000	.....
May	16,510,000	.....	17,973,000	.....	21,255,000	.....
June	16,866,000	.....	19,134,000	.....	19,000,000	.....
Second quarter	45,816,000	.....	50,072,000	.....	.....	.....
July	17,134,000	.....	18,812,000	.....	17,301,000	.....
August	16,995,000	.....	18,583,000	.....	15,718,000	.....
September	16,571,000	.....	18,087,000	.....	14,188,000	.....
Third quarter	50,700,000	.....	55,482,000	.....	.....	.....
October	16,596,000	.....	17,486,000	.....	13,334,000	.....
November	14,193,000	.....	11,276,000	.....	16,243,000	.....
December	10,744,000	.....	6,432,000	.....	20,616,000	.....
Fourth quarter	41,533,000	.....	35,194,000	.....	.....	.....
	164,057,000	.....	161,781,000	.....	.....	.....

*Revised.

IMPORTS OF HYDRAULIC CEMENT BY COUNTRIES AND DISTRICTS, IN JANUARY, 1927

Imported from	District into which imported	Barrels	Value
Belgium	Florida	57,858	$74,598
	Galveston	6,000	9,208
	Los Angeles	6,065	8,520
	Massachusetts	77,721	95,272
	Oregon	5,466	7,614
	Porto Rico	16,852	31,227
	Total	169,962	$226,439
Canada	St. Lawrence	525	$977
Denmark and Faroe Islands	Porto Rico	3,000	$4,518
France	New Orleans	131	$520
	New York	300	1,047
	Total	431	$1,567
Japan	Hawaii	12,500	$24,494
Netherlands	Porto Rico	4,257	$6,487
United Kgdom.	New Orleans	500	$1,147
	Oregon	1,000	1,898
	Washington	1,000	2,134
	Total	2,500	$5,179
	Grand total	193,175	$269,661

EXPORTS AND IMPORTS* EXPORTS OF HYDRAULIC CEMENT BY COUNTRIES, IN JANUARY, 1927

Exported to	Barrels	Value
Canada	1,944	$ 8,844
Central America	8,745	24,938
Cuba	12,562	31,670
Other West Indies & Bermuda	5,054	12,528
Mexico	6,174	20,089
South America	35,924	125,364
Other conntries	4,943	30,639
	75,346	$254,072

*Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision.

DOMESTIC HYDRAULIC CEMENT SHIPPED TO ALASKA, HAWAII AND PORTO RICO IN JANUARY, 1927*

	Barrels	Value
Alaska	62	$ 203
Hawaii	29,285	62,989
Porto Rico	33,857	82,930
	63,204	$146,122

Australian Cement Production Increasing

CONTRACTORS and buyers generally have been aware that during recent years large expansion has taken place in the cement industry in Australia, and, according to an official estimate, the output is now about 6,000,000 casks of six to the ton.

There are now 11 companies in existence, of which several are increasing the capacity of their plants with a view to reducing costs by mass production in accordance with the experience in other countries. One of the largest companies, now producing about 720,000 casks annually, has entered into contracts for the supply of machinery to make an additional 360,000 casks, giving a total annual capacity of 1,080,000 casks. This new factory is being laid out on a four-unit basis, each unit having a capacity of 360,000 casks, provision being made for the rapid installation of additional units as they may be required from time to time.

Despite the large local production and heavy customs duty, imports during the year ended June, 1923, amounted to 889,398 cwt., or nearly a double those of the previous year. Owing to a duty of 1s. per cwt. paid on British cement as against 1s. 6d. on imports from other sources that product accounted for 738,476 cwt. of the imports in 1923. Norway, supplied 109,981; Denmark, 38,344; and the United States, 1,758 cwt.

It is considered that if the full production of cement in Australia, which it is claimed will shortly be equal to the demand, is to be absorbed, consumption will have to increase largely in the near future or heavy losses will be incurred in the industry.—*Contract Journal, London, England.*

New Ship Called "B. F. Affleck"

TO BE USED in the iron ore, limestone and coal trade on the Great Lakes, the new 600-ft. steamship, "B. F. Affleck," is being built for the Pittsburgh Steamship Co.

This modern 10,000-ton steel freighter under construction at Toledo is one of two ships that are being added to the Pittsburgh Steamship Co.'s fleet. It is named for Benjamin Franklin Affleck, president of the University Portland Cement Co., a United States Steel Corporation subsidiary, with plants at Chicago, Pittsburgh and Duluth.

Enlargement of lake-carrying service is in line with other recent activities of the Universal company which is just completing a three-million-dollar expansion program at its Chicago (Buffington, Ind.) plant which includes construction of a new harbor, rock, storage yard and lighthouse. This development will make possible prompt shipments by boat of finished cement to all lake ports as well as expeditious receipt of raw material.

Soviet Cement Exports Increase

EXPORT of cement from the Soviet Union during the Soviet fiscal year ending September 30 last, broke all Russian records, being nearly six times the pre-war rate. The exports for the fiscal year were 38,482 metric tons, as compared with 30,078 metric tons in 1924-1925 and 6,903 metric tons in 1913.—*Buffalo (N. Y.) Times.*

EXPORTS AND IMPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1926 AND 1927

Month	Exports 1926 Barrels	Exports 1926 Value	Exports 1927 Barrels	Exports 1927 Value	Imports 1926 Barrels	Imports 1926 Value	Imports 1927 Barrels	Imports 1927 Value
January	72,939	$ 216,431	75,346	$254,072	360,580	$ 576,717	193,175	$269,661
February	73,975	220,706	.....	.....	314,118	527,948	.....	.....
March	69,080	205,647	.....	.....	493,241	812,968	.....	.....
April	96,296	284,772	.....	.....	257,302	398,114	.....	.....
May	78,601	224,365	.....	.....	223,130	337,031	.....	.....
June	80,684	248,814	.....	.....	335,570	495,744	.....	.....
July	130,822	370,220	.....	.....	250,862	395,981	.....	.....
August	64,946	216,489	.....	.....	350,638	560,532	.....	.....
September	70,920	239,174	.....	.....	194,129	308,224	.....	.....
October	69,389	225,874	.....	.....	263,403	386,335	.....	.....
November	76,598	238,103	.....	.....	55,233	82,949	.....	.....
December	89,976	305,238	.....	.....	151,850	246,293	.....	.....
	974,226	$2,995,833	.....	.....	3,250,056	$5,128,836	.....	.....

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

(These are the most recent quotations available at this printing. Revisions, corrections and supplemental information will be welcomed by the editor.)

Stock	Date	Par	Price bid	Price asked	Dividend rate
Allentown Portland Cement Co. (common)[32]	Mar. 14	.....	2	4	
Allentown Portland Cement Co. (6% bonds, 1932)[32]	Mar. 14	.....	86	.....	
Alpha Portland Cement Co. (common)[2] new stock	Mar. 14	No par	38	40	75c Jan. 15
Alpha Portland Cement Co. (preferred)[2]	Mar. 14	100	115	.....	1¾% quar. Mar. 1
American Lime and Stone Co. (7% bonds, 1942)[32]	Mar. 14	.....	98	101	
Arundel Corporation (sand and gravel—new stock)	Mar. 15	No par	35⅜	35⅜	45c qu., 20c ex. Jan. 3
Atlantic Gypsum Products Corp. (1st 6's carrying 10 sh. com.)[10]	Mar. 15	.....	110	114	
Atlas Portland Cement Co. (common)[2]	Mar. 14	No par	42	44	50c qu. March 1
Atlas Portland Cement Co. (preferred)	.....	100	.....	.....	2% quar. Oct. 1
Atlas Portland Cement Co. (preferred)[2]	Mar. 14	33⅓	43	.....	2% quar. Jan. 3
Beaver Portland Cement Co. (1st Mort. 7's)[8]	July 29	100	100	100	
Bessemer Limestone and Cement Co. (Class A)[4]	Feb. 25	.....	32	32½	
Bessemer Limestone and Cement Co. (6% bonds)[4]	Feb. 25	.....	99	100	
Boston Sand and Gravel Co. (common)	Mar. 13	100	73	75	1% qu., 2% ex. Jan. 1
Boston Sand and Gravel Co. (preferred)	Mar. 12	.....	.....	85	1¾% quar. Jan. 1
Boston Sand and Gravel Co. (1st preferred)	Mar. 12	.....	.....	90	2% quar. Jan. 1
Canada Cement Co., Ltd. (common)	Mar. 15	100	.....	136	2% Jan. 4
Canada Cement Co., Ltd. (preferred)[11]	Mar. 11	100	116	119	1¾% quar. Feb. 16
Canada Cement Co., Ltd. (1st 6's, 1929)[11]	Mar. 11	.....	101	102	3% semi-annual A&O
Canada Crushed Stone Corp., Ltd. (6½s, 1944)[11]	Mar. 11	100	93	96	
Charles Warner Co. (lime, crushed stone, sand and gravel)	Mar. 11	No par	23	25	75c Jan. 12
Charles Warner Co. (preferred)	Mar. 11	100	100	104	1¾% quar. Jan. 27
Charles Warner Co. (lime, crushed stone, sand and gravel) 7s, 1929[16]	Mar. 11	100	102	103½	
Cleveland Stone Co. (new stock)	Mar. 1	.....	52	52	50c qu.; 25c ex. Mar. 15
Connecticut Quarries Co. (1st Mortgage 7% bonds)[17]	Mar. 11	100	104	.....	
Consolidated Cement Corp. (1st Mort., 6½s, series A)[34]	Mar. 15	100	97	99	
Consolidated Cement Corp. (5 yr. 6½% gold notes)[24]	Mar. 15	100	96½	100	
Consumers Rock and Gravel Co. (1st Mort. 7s)[18]	Mar. 10	100	99½	101½	
Coosa Portland Cement Co. (6% bonds, 1944)[32]	Mar. 14	.....	65	.....	
Coplay Portland Cement Co. (6% bonds, 1941)[32]	Mar. 14	.....	88	.....	
Dewey Portland Cement Co. (1st mort. 6's 1942)[30]	Mar. 15	100	98½	100	
Dolese and Shepard Co. (crushed stone)[7]	Mar. 15	50	96	100	$1.50 Jan. 1, $1.50 ex. Jan. 1
Egyptian Portland Cement Co. 7% pfd.[21]	Mar. 12	.....	90	100	1¾% quar. Oct. 1
Egyptian Portland Cement Co. (common)[21]	Mar. 12	.....	7½	9	40c quar. Oct. 1
Fredonia Portland Cement Co. (6½% bonds, 1940)[32]	Mar. 14	.....	97	101	
Giant Portland Cement Co. (common)[2]	Mar. 14	50	65	75	
Giant Portland Cement Co. (preferred)[25]	Mar. 14	50	43	48	3½% and 19% ex. Dec. 15
Ideal Cement Co. (common)	Mar. 15	No par	85½	87½	$1 quar., $1 ex. Dec. 15
Ideal Cement Co. (preferred)[33]	Mar. 15	100	111	112	1¾% quar. Dec. 15
International Cement Corporation (common)	Mar. 15	No par	50⅜	51¼	$1 quar. Mar. 31
International Cement Corporation (preferred)[2]	Mar. 12	100	106	107	1¾% quar. Mar. 31
Kelley Island Lime and Transport Co.	Mar. 14	100	135	135	$2 quar., $2 ex. Jan. 2
Lawrence Portland Cement Co.[3]	Mar. 11	100	95	100	2% quar.
Lehigh Portland Cement Co.[6]	Mar. 14	50	92	95	1½% quar.
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1927 to 1931)[13]	Dec. 18	100	98	100	
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1931 to 1935)[13]	Dec. 18	100	97	98½	
Marblehead Lime Co. (1st Mort. 7's)[14]	Mar. 12	100	100	.....	
Marblehead Lime Co. (5½% notes)[14]	Mar. 12	100	98	.....	
Michigan Limestone and Chemical Co. (common)[6]	Mar. 14	.....	26	28	
Michigan Limestone and Chemical Co. (preferred)[6]	Mar. 14	.....	24	26	1¾% quar. July 15
Missouri Portland Cement Co.	Mar. 15	25	46½	47	50c Feb. 1
Monolith Portland Cement Co. (common)[9]	Mar. 10	.....	12½	12¾	8% ann. Jan. 2
Monolith Portland Cement Co. (units)[9]	Mar. 10	.....	31½	32¼	
Monolith Portland Cement Co. (preferred)[9]	Mar. 10	.....	9½	9¾	
National Gypsum Co. (common)[35]	Mar. 15	.....	34	36	
National Gypsum Co. (preferred)[35]	Mar. 15	.....	68	72	
Nazareth Cement Co.[26]	Mar. 11	No par	.....	33	75c quar. Apr. 1
Newaygo Portland Cement Co.[1]	Mar. 14	.....	110	115	
Newaygo Portland Cement Co. (6½% bonds, 1938)[32]	Mar. 14	.....	99	102	
New England Lime Co. (Series A, preferred)[14]	Mar. 12	100	.....	95	
New England Lime Co. (Series B, preferred)[23]	Mar. 14	100	95	97	
New England Lime Co. (V.T.C.)[22]	Mar. 14	.....	33	36	
New England Lime Co. (6s, 1935)[14]	Mar. 12	100	99	101	
New York Trap Rock Corp. (6% bonds, 1946)[32]	Mar. 14	.....	95	100	
North American Cement Corp. 6½s 1940 (with warrants)	Mar. 14	100	90⅝	90⅝	
North American Cement Corp. (units of 1 sh. pfd. plus ½ sh. common)[32]	Mar. 14	.....	70	80	2 mo. period at rate of 7%
North American Cement Corp. (common)[19]	Nov. 8	.....	20	22	
North American Cement Corp. (preferred)	Jan. 28	.....	.....	.....	1.75 quar. Feb. 1
North Shore Material Co. (1st Mort. 6's)[15]	Mar. 15	100	98½	100	
Pacific Portland Cement Co., Consolidated[5]	Mar. 11	100	67	70	25c mo.
Pacific Portland Cement Co., Consolidated (secured serial gold notes)[5]	Mar. 11	100	.....	98	3% semi-annual Oct. 15
Peerless Portland Cement Co.[1]	Mar. 14	10	4¾	5¼	
Pennsylvania-Dixie Cement Corp. (1st Mort. 6's)[29]	Mar. 15	100	100¼	100½	
Pennsylvania-Dixie Cement Corp. (preferred)[28]	Mar. 14	100	99¼	99⅜	1¾% March 15
Pennsylvania-Dixie Cement Corp. (common)[28]	Mar. 15	.....	34¾	35	80c April 1
Petoskey Portland Cement Co.[1]	Mar. 15	10	9½	10	1½% quar.
Pittsfield Lime and Stone Co.[31]	Feb. 14	.....	.....	100	
Pittsfield Lime and Stone Co.[31] (common)	Feb. 14	.....	.....	25	

(CONTINUED ON PAGE 76)

[1]Quotations by Watling, Lerchen & Hayes Co., Detroit, Mich. [2]Quotations by Bristol & Willett, New York. [3]Quotations by True, Webber & Co., Chicago. [4]Quotations by Butler, Beading & Co., Youngstown, Ohio. [5]Quotations by Freeman, Smith & Camp Co., San Francisco, Calif. [6]Quotations by Frederic H. Hatch & Co., New York. [7]Quotations by F. M. Zeiler & Co., Chicago, Ill. [8]Quotations by Ralph Schneeloch Co., Portland, Ore. [9]Quotations by A. E. White Co., San Francisco, Calif. [10]Quotations by Lee, Higginson & Co., Boston and Chicago. [11]Nesbitt, Thomson & Co., Montreal, Canada. [12]E. B. Merritt & Co., Inc., Bridgeport, Conn. [13]Peters Trust Co., Omaha, Neb. [14]Second Ward Securities Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois, Chicago. [16]J. S. Wilson Jr. Co., Baltimore, Md. [17]Chas. W. Scranton & Co., New Haven, Conn. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hemphill, Noyes & Co., New York. [20]Quotations by Bond & Goodwin & Tucker, Inc., San Francisco. [21]Baker, Simonds & Co., Inc., New York. [22]William C. Simons, Inc., Springfield, Mass. [23]Blair & Co., New York and Chicago. [24]A. B. Leach and Co., Inc., Chicago. [25]A. C. Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [27]J. G. White and Co., New York. [28]Mitchell-Hutchins Co., Chicago, Ill. [29]National City Co., Chicago, Ill. [30]Chicago Trust Co., Chicago. [31]McIntyre & Co., New York, N. Y. [32]Hepburn & Co., New York. [33]Boettcher & Co., Denver, Colo. [34]Kidder, Peabody & Co., Boston, Mass. [35]Farnum, Winter and Co., Chicago.

Editorial Comment

City Operations

The problems of quarry and gravel-pit operations within large city limits are constantly increasing. In the case of quarries, blasting is always a bone of contention, and however long the quarry operator is able to stave off legal action or public opposition, he may be certain he will some day have to face it. In some communities, also, objection is now being made to gravel-pit operations because of the unsightly and dangerous holes left. It is the age-old problem of utility versus aesthetic and sentimental considerations; and in spite of the injustice done producers, experience shows that the public will eventually have its way. The producer of the future will look for a site as near the population centers as feasible; then try to isolate his operation.

Quality Competition

ROCK PRODUCTS ventured the opinion something more than a year ago, when two of the national associations in the mineral aggregate field had established engineering or research departments, that this line of activity, or direction of co-operative energies, would result eventually in bringing the two industries closer together. Developments in the last year have not changed our opinion, nor our point of view. And, so long as each organization is honest in its endeavor to determine the truth for the benefit of the users of these materials, there will be a certain community or mutuality of interests.

The common interest is concentration on *quality* materials. For the activities of the two associations during the past year have certainly laid great emphasis on the quality of aggregates going into concrete, whether gravel or stone, and there is no doubt that users have been duly impressed. Such prominence to quality, since it is a genuine service to the public, cannot but result in advantage to both industries, although it is certainly causing embarrassment, and will continue to cause embarrassment, to a few producers who find themselves unable to produce quality materials.

When *relative* values for various grades of quality have been somewhere near determined, a great many of the hardest problems of competition may be removed. For a gravel producer who can produce a material equal or better than a crushed-stone competitor, and a crushed-stone producer who can supply a material equal or better than a gravel competitor, are certainly somewhere near the same competitive basis. There may be more profit in the gravel at the current price for *good* aggregate, but there is little reason or inducement to make great differences in the prices of a material which serves the same purpose equally well, merely because the method of preparation differs.

Flints in Limestone

In August, 1924, *Engineering News-Record* published a paper by F. V. Reagel, testing engineer of the Missouri State Highway Commission, on the popping and cracking that had been found in a concrete highway pavement in Missouri where limestone containing chert was used as aggregate. The paper was abstracted in ROCK PRODUCTS for October 4, 1924. It must have been widely read by engineers and taken very seriously for almost from the date of its publication complaints have been made by producers that there was a disposition on the part of engineers to reject limestones containing either flint or chert, even those limestones which had been successfully used as aggregates for 20 years or more.

As Dr. Loughlin pointed out in his paper read before the recent American Concrete Institute convention, there is no minerological or petrological reason why flint and chert should not make excellent aggregates. In England crushed flints have been considered a preferred aggregate. And the numerous gravel deposits composed of flints that remained after the limestones which originally contained them had been dissolved and washed away are a sufficient proof that these minerals will resist weathering.

It seems that a great injury has been done the crushed-stone industry by trying to make a general rule from a particular case. Undoubtedly Mr. Reagel found what he said he found. But, so far as we know, no other experimenter has reported finding the same results using flinty and cherty limestones from other parts of the country. And no other highway department than that of Missouri, so far as we have been informed, condemns limestone which contains flint or chert.

Dr. H. F. Kriege, now with the France Stone Co., told one of the editors of ROCK PRODUCTS that he had examined some of the Missouri chert that was said to have caused failure and found seams filled with minute crystals of pyrite. This might explain the particular failure reported, as the deleterious effect of some pyrite is well known. It not only weathers but produces sulphuric acid that attacks the cement. But even here it is not safe to generalize for other pyrites, as Dr. Loughlin showed, have resisted weathering for hundreds of years.

It is the right of every producer to have his stone judged on its own merits and not by the stone in another state or even in the next township. In these days when testing laboratories of unquestioned standing are abundant the facts concerning any building material may be secured and used to combat prejudice against a particular kind of rock or the formation or locality from which it comes.

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS (Continued)

Stock	Date	Par	Price Bid	Price Asked	Dividend Rate
Rockland and Rockport Lime Corp. (1st preferred)[34]	Mar. 11	100	103	104	3½% semi-annual Feb. 1
Rockland and Rockport Lime Corp. (2nd preferred)[34]	Mar. 11	100	60	.....	3% semi-annual Feb. 1
Rockland and Rockport Lime Corp. (common)[34]	Mar. 11	No par	50	55	1½% quar. Nov. 2
Sandusky Cement Co. (common)[1]	Mar. 14	100	125	128	$2 qu., $4 ex. Jan. 1
Santa Cruz Portland Cement Co. (bonds)[8]	Mar. 11	.....	.....	105¾	6% annual
Santa Cruz Portland Cement Co. (common)[8]	Mar. 11	.....	85	.....	$1 quar., $1 ex. Jan. 1
Schumacher Wallboard Corp. (common)	Feb. 11	.....	23¾	24	
Schumacher Wallboard Corp. (preferred)	Feb. 11	.....	27¾	.....	
Superior Portland Cement, Inc. (Class A)[20]	Mar. 12	.....	43¼	44¼	
Superior Portland Cement, Inc. (Class B)[20]	Mar. 12	.....	22	22½	
United Fuel and Supply Co. (sand and gravel) 1st Mort. 6s[27]	Mar. 11	100	98	100	
United Fuel and Supply Co. (sand and gravel) 6% gold notes[27]	Mar. 11	100	98	100	
United States Gypsum Co. (common)	Mar. 15	20	95⅝	96½	40c quar. March 31
United States Gypsum Co. (preferred)	Mar. 15	100	118	120	1¾% quar. March 31
Universal Gypsum Co. (common)[3]	Mar. 15	No par	6¼	6¾	
Universal Gypsum V.T.C.[3]	Mar. 15	No par	5½	6	
Universal Gypsum Co. (preferred)[3]	Nov. 23	.....	73	77	1½% Feb. 15
Universal Gypsum and Lime Co. (1st 6's, 1946)[3]	Mar. 15	100	.....	96	
Union Rock Co. (7% serial gold bonds)[15]	Mar. 11	100	99	101	
Upper Hudson Stone Co. (1st 6's, 1951)[32]	Mar. 14	.....	94	.....	
Upper Hudson Stone Co. (1st 6's, 1937)[32]	Mar. 14	.....	94	.....	
Vulcanite Portland Cement Co. (7½% bonds, 1943)[32]	Mar. 14	.....	105	.....	
Wisconsin Lime and Cement Co. (1st Mort. 6s, 1940)[18]	Mar. 15	100	98½	100	
Wolverine Portland Cement Co.	Mar. 15	10	5¼	6	1½% Feb. 15

QUOTATIONS OF INACTIVE ROCK PRODUCTS SECURITIES

Stock	Date	Par	Price bid	Price asked	Dividend rate
Atlanta Shope Brick and Tile Co.[1]	Nov. 24	.....	25c	.....	
Benedict Stone Corp. (cast-stone) (50 sh. pfd. and 390 sh. com.)[1]	Dec. 29	.....	$400 for the lot	.....	
Coplay Cement Mfg. Co. (common) (4)	Dec. 16	.....	12½	.....	
Coplay Cement Mfg. Co. (preferred) (4)	Dec. 30	.....	70	.....	
Eastern Brick Corp. 7% cu. pfd.) (4)	Dec. 9	10	40c	.....	
Eastern Brick Corp. (sand lime brick) (common) (4)	Dec. 9	10	40c	.....	
Edison Portland Cement Co. (common)[4]	Sept. 11	50	20c	.....	
Edison Portland Cement Co. (preferred)	Nov. 3	50	17½c(x)	.....	
International Portland Cement Co., Ltd. (preferred)	Mar. 1	.....	30	45	
Globe Phospate Co. ($10,000 1st mtg. bonds, $169.80 per $1000 paid on prin.)	Dec. 22	.....	$50 for the lot	.....	
Iroquois Sand & Gravel Co., Ltd. (2 sh. com. and 3 sh. pfd.) (1)	Mar. 17	.....	$12 for the lot	.....	
Limestone Products Corp. (150 sh. pfd., $50 par, and 150 sh. com., no par)	Dec. 22	.....	$60 for the lot	.....	
Missouri Portland Cement Co. (serial bonds)	Dec. 31	.....	104¾	104¾	3¼% semi-annual
Olympic Portland Cement Co. (g)	Oct. 13	.....	.....	£1⅝	
Phosphate Mining Co. (3)	Nov. 24	.....	1	.....	
River Feldspar and Milling Co. (50 sh. com. and 50 sh. pfd.) (1)	June 23	.....	$200 for the lot		
Rockport Granite Co. (1st 6's, 1934)[2]	Aug. 31	.....	90	.....	
Simbroco Stone Co. (pfd.)	Dec. 12	.....	.....	.....	$2 Jan. 1
Southern Phosphate Corp.[6]	Sept. 15	.....	1¼	.....	
Tidewater Portland Cement Co. (3000 sh. com.)	Dec. 22	.....	$6525 for the lot	.....	
Vermont Milling Products Co. (slate granules) 22 sh. com. and 12 sh. pfd. (5)	Nov. 3	.....	$1 for the lot	.....	
Wabash Portland Cement Co.[1]	Aug. 3	50	60	100	
Winchester Brick Co. (preferred) (sand lime brick) (5)	Dec. 16	.....	10c	.....	

(g) Neidecker and Co., Ltd., London, England. (1) Price obtained at auction by Adrian H. Muller & Sons, New York. (2) Price obtained at auction by R. L. Day and Co., Boston. (3) Price obtained at auction by Weilepp-Bruton and Co., Baltimore, Md. (4) Price obtained at auction by Barnes and Lofland, Philadelphia, Pa. (5) Price obtained at auction for lot of 50 shares by R. L. Day and Co., Boston, Mass. (x) Price obtained at auction by Barnes and Lofland, Philadelphia, on November 3, 1925. (6) Price obtained at auction by Wise, Hobbs and Arnold, Boston, Mass.

Weston and Brooker Bonds Offered

THE South Carolina National Bank, Charleston, S. C., are offering $150,000 first mortgage 10-year serial 7% sinking fund bonds of the Weston & Brooker Co., Columbia, S. C. Priced according to maturities, 1928-30, inclusive, to yield 6%, and 1931-37, inclusive, to yield 7%. Dated January 1, 1927. Due January 1, 1937. Callable at 30 days' notice on any interest date in inverse order of maturity at 105 and accrued interest until January, 1931, and at a reduction of ½ of 1% for each 6 months thereafter. Denominations: $1,000 and $500.

The following data are from the underwriter's description of the issue:

History and Business. The Weston & Brooker Co. own and operate one of the largest and most modern rock crushing plants and granite quarries in the Southeast. Situated just outside of the city limits of Columbia, S. C., the quarry was, prior to the purchase by Weston & Brooker in 1912, owned and operated by Christelow & Heyworth of Jacksonville, Fla., and was utilized for quarrying jetty stone and the entire operation was steam-driven. After the purchase by Weston & Brooker the plant was modernized, and by 1917 the steam-driven machinery had been replaced by modern electric equipment throughout. In 1921 the Weston direct-drive crusher was installed. This is an invention of W. S. Weston, vice-president of the company, and is used and recognized generally as standard equipment. This plant is designed and equipped for a present capacity of 175 tons of crushed stone per hour, with provisions for doubling by enlarging conveyors when necessary.

Earnings. Average earnings for the past five years before depreciation applicable to interest were $42,215.59, and if allowance is made therein for interest paid on borrowed money which will be eliminated as a result of this financing, the average earnings would have been $45,546.84, or more than four times maximum interest requirements and over twice maximum interest and maturity requirements.

Security. These bonds constitute a direct obligation of the Weston & Brooker Co. and are secured by a closed first mortgage on the company's entire fixed assets, appraised by Messrs. J. E. Sirrins & Co. of Greenville, S. C., and Walter T. Love & Co. of Columbia, S. C., as having a conservative value of $374,180.37, or $2,494.53 in security for each $1,000 bond of this issue presently to be outstanding. This equity is increased as the serial maturities are retired.

Being situated at Columbia, S. C., where railroad facilities are excellent, and with the present program for hard-surfacing roads in the coastal section of the southeastern states, the company's continued prosperity is believed to be assured.

Sinking Fund. Under the terms of the mortgage indenture the Weston & Brooker Co. must retire annually a specified number of bonds. A sum equal to one-twelfth of the annual interest and maturity requirements will be deposited monthly with the trustee; such payments to sinking fund shall begin on February 1, 1927, and continue thereafter throughout the life of the bond issue, thus constantly increasing the security behind the bonds, since no part of the property covered shall be released until the last outstanding bond has been paid.

Maturities. As given below:

$10,000 Jan. 1, 1928	$15,000 Jan. 1, 1933
10,000 Jan. 1, 1929	15,000 Jan. 1, 1934
15,000 Jan. 1, 1930	15,000 Jan. 1, 1935
15,000 Jan. 1, 1931	20,000 Jan. 1, 1936
15,000 Jan. 1, 1932	20,000 Jan. 1, 1937

Purpose of Issue. The proceeds of this issue will be used for additional equipment and to provide additional working capital made necessary by the increased demand for the company's products and to provide facilities for further expansion in the volume of business which will result from the paving program for South Carolina, which is now under way, which was made possible by the Supreme Court decision authorizing the borrowing by counties against highway reimbursement certificates.

Insurance. The property must be insured

at all times against fire in an amount equal to at least the amount of outstanding bonds, with loss payable to the trustee for the benefit of the bond holders.

Legality. All legal proceedings incident to this issue have been approved by Messrs. Herbert and Dial, of Columbia, S. C.

WESTON & BROOKER CO. STATEMENT OF CONDITIONS

(As of the close of business December 31, 1926, reflecting this financing)

ASSETS

Cash in banks	$ 22,048.45	
Accounts receivable	31,265.74	
Inventory	10,150.00	
Currents assets		$ 63,464.19
Officers' accounts		5,849.24
Real estate	83,000.00	
Buildings, machinery and equipment	291,180.37	
Fixed assets		374,180.37
Other assets		9,064.41
		$452,558.21

LIABILITIES

Accrued wages	$ 648.50	
Weston & Brooker Engineers, Inc.	877.09	
Total current liabilities		$ 1,525.59
First mortgage serial gold bonds		150,000.00
Capital stock (common) authorized	200,000.00	
Not issued	40,500.00	
Issued	159,500.00	
Treasury stock purchased	16,650.00	
		142,850.00
Surplus		158,182.62
		$452,558.21

New England Lime Earnings

NEW ENGLAND LIME CO. reports net income of $322,824, after depreciation, for the year ended November 30, 1926. The following is a comparative report for 1926 and 1925:

NEW ENGLAND LIME CO. CONDENSED BALANCE SHEET

(Audit Figures)

ASSETS

	November 30 1926	1925
Cash	$ 256,618	$ 224,498
Receivables	128,623	100,166
Inventories	140,346	158,802
	$ 525,587	$ 483,466
*Quarries, buildings, machinery, etc.	3,697,384	3,689,728
Investments	108,078	.....
Bond discount, etc.	139,796	146,359
Total	$4,470,845	$4,319,553

LIABILITIES

Payables	$ 8,332	$ 2,869
Accrued wages, interest, preferred dividends and federal taxes	108,171	79,001
	$ 116,503	$ 81,870
First mortgage 6s, due 1935	1,350,000	1,350,000
7% pfd. stock—series A	600,000	600,000
7% pfd. stock—series B	400,000	400,000
30,000 sh. no par common stock	1,788,523	1,788,524
Surplus	215,819	99,159
Total	$4,470,845	$4,319,553

*After reserves.

STATEMENT OF INCOME FOR 12 MONTHS

(Ended November 30, 1926)

Net sales	$1,798,010
Net income after depreciation	322,824
Interest on funded debt	81,000
Provision for federal income tax	41,665
Preferred stock dividends—series A	42,000
Preferred stock dividends—series B	28,000

Financial History of the United States Gypsum Company

Remarkable Return to Investors Shown During Last Few Years—How Surplus Earnings Have Been Invested

By John A. Mirt

(Reprinted from Chicago Journal of Commerce)

HOW an investment of $1,000 a little more than six years ago has turned into a nest-egg of $22,000 is a story which might be written from the history of the United States Gypsum Co., a Chicago corporation which has risen to the leadership in its line of industry. Few people realize that U. S. Gypsum common, one of the speculative favorites on the Chicago Stock Exchange, went begging six years ago and that anyone who then had the courage to believe in the future of that company has been well repaid for his faith.

And yet, for the last few years the annual meetings of the company have been marked by numerous queries on the part of stockholders as to the reason for an apparently too conservative dividend policy on the part of the board. Holders looking at the regular dividend rate on the common see payments being made on the basis of 8% a year, or $1.60. With anywhere from $11.35 to $15.59 a share earned on the common in the last five years, the point is made that a larger regular dividend is justified and should be established. True, there may have been cash extras and stock dividends, they admit, but these have not been at any stated period, and the claim is made that the dividend is too irregular. But could any regular dividend policy have been any more profitable to stockholders over a period of years than this irregular one?

Pays 350% Annual Profit on Original Investment

Stock purchased at the low price in 1920 has paid for itself 2.3 times over out of cash dividends alone in the six years following; the annual cash dividend has been equivalent to 38½% on the original cost. Taking into consideration the stock dividends paid in the interval and a current market value of around 95 for the common, the cash dividends and market value of the present holdings are equivalent to a 350% a year profit on the original investment. No, that last figure of 350% a year return over a six-year period, or 2100% in all, is not a typographical error. It is a fact. A few minutes of simple arithmetic prove it. Just glance over the table below, which is on the basis of the purchase of 100 shares late in 1920 at $14 a share.

From the foregoing table it can be seen that 100 shares originally had grown into approximately 290½ shares, with a market value at 95 of about $27,600. In the meantime the cash dividend return has amounted to $3,239, making a total of $30,839. Subtracting the original cost of $1,400, there remains a profit of $29,430. Dividing that by six years, the annual profit amounts to $4,906.50, which, on the basis of a $1,400 investment, gives the 350% annual profit. The total cash dividend averages $539.90 annually over the six-year period, or equivalent to 38½% on the original investment. Whether the original investment in 1920 was one share or 1000 shares, the final result is the same, a cash dividend return of 38½% a year and a profit of 350% annually. Evidently, an irregular dividend policy is a paying one for stockholders at times. It is only a matter of sitting down and doing a little figuring to see its advantages.

Later Investors Have Fared Well

But, you say that big return applies only to some of the old holders who invested in the company when it was just starting out on a wave of prosperity. What of later investors? How have they fared? Naturally, anyone who places his savings into a company at a time when its position has not yet been firmly established should derive the largest return when that company becomes prosperous and a leader in its line of endeavor. But those who "climbed upon the bandwagon" as late as in 1923 have no complaint from an investment and speculative standpoint.

In 1923, the low price of the common stock was 50. An investment at that price in the three succeeding years returned a cash dividend yield averaging 14.3% a year, and, considering the stock dividends and market price of 95 a share for the total holdings,

ANNUAL RETURN BASED ON 100 SHARES OF U. S. GYPSUM COMMON PURCHASED IN 1920

Year	Stock dividend Pct.	*Shares	Total holding	Cash dividends A share	*Amount	Yield at cost
1921	5	5.	105	$0.80	$ 80.00	5.7%
1922	10	10.5	115.5	0.80	84.00	6.0%
1923	20	23.1	138.6	0.80	92.40	6.6%
1924	35	48.51	187.11	6.20	859.32	61.3%
1925	15	28.066	215.176	5.60	1,047.82	74.8%
1926	35	75.312	290.488	5.00	1,075.88	76.8%

*On basis of holdings at end of previous year.

there has been an average annual profit of 113%. Such investments are, indeed, a rarity. For a confirmation of these figures, see Table I, based on the purchase in 1923 of 100 shares at $50 a share.

The average annual cash dividend return, according to the foregoing, was $717.41, or 14.3%. The total dividend of $2,152 for the three years and a market value of approximately $19,910 for the more than 209½ shares of stock amounts to about $22,062. Deducting the original cost of $5,000, the three-year profit is $17,062, or an average of $5,687 for the year, which gives a 113% annual profit on the original investment. Irregular dividends should become popular; but they don't all work out this way.

Old holders of the preferred stock have shared in the market appreciation of the common, since in 1915 dividend accumulations on the preferred were cleared up by the payment of 6½% in cash and 43% in common stock. From 1916 the preferred has an unbroken dividend record.

Marketwise, the two classes of stock have ranged as shown in Table II.

What has been responsible for this remarkable advance in the investment value of Gypsum common? The answer is a simple one. The company is a manufacturer of products which have found a steadily increasing demand for building purposes and which by reason of the fact that the company was in position to produce at a cost relatively lower than many of its competitors could be marketed at a generally lower price and yet yielding a good margin of profit on invested capital and the comparatively small stock capitalization. But that is only one of the reasons for the prosperity of the company. It could not have built up its position in the trade unless a conservative cash dividend policy had been followed. An alternative was to resort to financing, but that course did not appeal to the management. Instead, surplus earnings have been invested in additional properties and the return has proven the policy to have been a wise one. Year by year, this investment of earnings is being capitalized through the distribution of substantial stock dividends.

Year by year, also, the earnings of United States Gypsum have been mounting, with a peak in operating profits being reached in 1926. Were it not for the fact that a larger amount was charged off for depreciation and depletion last year, the 1926 net income, after federal taxes and all other charges, would have surpassed that of any other year in the history of the corporation. As a matter of fact, the net of $8,375,747 was within less than $39,000 of the record reported in 1925. Keeping pace with the larger earnings has been an increased common stock capitalization, as a result of the liberal stock dividend policy, and the per share earnings, therefore, have been maintained within a range of slightly more than $4 a share over the last five years.

Record of Earnings in Detail

For more details as to the record of earnings over the last eight years, the following table (No. IV) is presented.

The decline of $4.10 a share in earnings on the common stock as compared with 1925 is due to the fact that a stock dividend of 35% paid on the last day of 1926 was included in figuring the per share earnings. This dividend brought the total outstanding common capitalization to 687,875 shares, as compared with 506,915 shares at the end of 1925. As to the amounts available for common dividends in 1926 and 1925, there was very little difference. It also is well to remember that the common is of $20 par value. To figure the per cent earned on the common one need only multiply the dollar earnings by five. In other words, 56.75% was earned on the junior issue in 1926 and 77.25% in 1925, proving that the stockholders have fared much better through the reinvestment of earnings in property than they could possibly have done by receiving these earnings in the form of dividends and reinvesting them elsewhere.

How the surplus earnings of the United States Gypsum Co. have been reinvested is indicated by the balance sheet of the company. In the last three years the surplus account has increased $9,792,434, including surplus paid in on capital stock. The common stock has been increased by $7,845,820, principally a result of stock dividends. The total of the two items is $17,638,254, which just about equals the $17,679,143 increase in plant, property and equipment in that period. The working capital has improved $4,938,631, while the outstanding preferred stock is up $2,421,300.

The company has maintained a strong working capital position during this period of upbuilding, the current assets at the end of every year in the last four being at least five times current liabilities. The inventories have been mounting, but only in proportion to the increase in net income. A large portion of quick assets has been in cash and United States government bonds, which has made it possible for the company to seize upon any advantageous proposition which presented itself. This strong working capital position is set forth in Table III.

Properties

The supply of gypsum rock of the United States Gypsum Co. is estimated at over 200,000,000 tons, assuring a supply of raw material for many years. The plants of the company are scattered throughout the country, with the principal properties at Chicago; Oakland, Akron and Union Springs, N. Y.; Cleveland, Gypsum and Genoa, Ohio; Detroit, Grand Rapids and Alabaster, Mich.; Fort Dodge, Iowa; Milwaukee and Superior, Wis.; Blue Rapids, Kan.; Eldorado and Southard, Okla.; Plasterco, Va.; Piedmont, S. D.; Denver and Loveland, Colo.; Sweetwater, Tex.; Canaan, Conn., and Cordova, Ill. In January, 1924, the company also acquired the J. B. King & Co. of New York,

TABLE I. NET RETURN OF U. S. GYPSUM COMMON BASED ON ORIGINAL PURCHASE OF 100 SHARES IN 1923

Year	Stock dividend Pct.	*Shares	Total holding	Cash dividends A share	*Amt.	Yield at cost
1924	35	35	135	$6.20	$620.00	12.4%
1925	15	20.25	155.25	5.60	756.00	15.1%
1926	35	54.25	209.587	5.00	776.25	15.5%

*Based on holdings at end of previous year.

TABLE II. PRICE RANGE OF U. S. GYPSUM CO. STOCK
(On Chicago Stock Exchange)

	1927	1926	1925	1924	1923	1922	1921
Common:							
High	109	171	208	175	91⅞	68¼	28¾
Low	93	125	112	78	50	51	12½
Preferred:							
High	116¼	121	118	120½	106	106	98
Low	115½	104	112	102½	102	100.	82

TABLE IV. U. S. GYPSUM CO. EARNINGS, 1919-26, INCLUSIVE

Year	*Operating expenses	Net after deprn., depln. and taxes	Pfd. divs.	†Com. divs.	Surplus	‡Per share earned on common
1926	$10,763,219	$8,375,747	$567,563	$6,116,088	$1,692,095	$11.35
1925	10,474,302	8,414,116	579,925	3,790,002	4,044,189	15.45
1924	8,825,697	7,166,381	592,077	4,292,515	2,281,789	14.96
1923	6,848,941	¶5,030,922	421,178	1,180,490	3,429,253	15.59
1922	4,370,770	¶3,119,033	418,881	619,659	2,080,493	12.19
1921	2,639,552	¶1,703,041	417,784	374,670	910,587	6.16
1920	§2,126,778	1,705,211	417,321	355,115	932,775	6.52
1919	§1,288,111	1,076,111	397,567	39,049	639,495	3.48

*After deducting all expenses incident to operations, including repairs and maintenance of plants. †Includes stock dividends as follows: 1926, 35%; 1925, 15%; 1924, 35%; 1923, 20%; 1922, 10%; 1921 and 1920, 5%. ‡Based on shares outstanding at end of year. ¶After depreciation and depletion. §After contingent reserve also.

TABLE III. U. S. GYPSUM CO. BALANCE SHEET
(As of December 31)

	1926	1925	1924	1923
Current assets:				
Cash	$ 1,123,703	$ 899,270	$ 1,277,287	$ 477,570
Marketable securities	5,647,006	6,515,129	4,551,928	3,513,926
Receivables	4,567,001	4,628,331	3,885,913	3,197,713
Advances	838,053	680,457	445,414	687,754
Inventories	3,754,122	3,319,318	3,107,081	2,004,395
Total current assets	$15,929,887	$16,042,507	$13,267,625	$9,881,361
Current liabilities:				
Accounts and dividends payable	$ 1,210,554	$ 1,183,038	$ 1,126,980	$1,059,523
Accruals	1,858,182	1,697,991	1,140,848	899,318
Total current liabilities	$ 3,068,737	$ 2,881,030	$ 2,267,829	$1,958,841
Net working capital	12,861,150	13,161,476	10,999,796	7,922,519
Ratio current assets to current liabilities	5.2 to 1	5.5 to 1	5.8 to 1	5.0 to 1

operating a fleet of plaster-carrying boats between its main factory at New Brighton, Staten Island, N. Y., and its gypsum mines at Windsor and Avondale, Nova Scotia, and at Hillsborough, New Brunswick.

Line of Products Is Extensive

The company manufactures all classes of gypsum products, including plasters, stucco and other building material. In recent years it has broadened its line and its product today includes "Sheetrock," a fireproof wallboard; "Textone," a decorative covering for gypsum wallboard; "Structolite Concrete," a structural material, and "Gyp-Lap," a gypsum exterior sheathing, all of which have found a ready market. It is estimated that the company supplies about 45% of the United States requirements of gypsum products.

Organization

Formed originally under New Jersey laws on December 27, 1901, to effect a merger of 35 producers of gypsum, there were several corporate name changes in August, 1920, with the original name being adopted again and the company incorporated under Illinois laws. It has numerous subsidiaries, including the United States Gypsum Co. of Delaware; the Canadian Gypsum Co., Ltd.; the Gypsum Plaster Board Co.; the Gypsum Packet Co., Ltd.; the Wentworth Gypsum Co., Ltd.; the United States Gypsum Transportation Co.; the Hillsborough Plaster Quarrying and Manufacturing Co., Ltd.; the Windsor Cement Co., Inc., of Connecticut, and the Windsor Cement Co. of Massachusetts.

Company Owns Valuable Patents

The United States Gypsum Co. owns some valuable patents. One in particular, involving the manufacture of covered edge wallboard, was decided in favor of the company in the middle of 1925, and a number of other companies using the process were held to be infringers. As a result, negotiations were undertaken for the collection of damages. Some of these damages were collected last year and are included in 1926 earnings. A license agreement which the U. S. Gypsum Co. has granted provides for the payment of 5% of the selling price to the company. This together with further damage payments will tend to offset to some extent any possible decline in earnings from operation in the next year or so.

To expect the company to do as well in the matter of expansion and appreciation in the value of its stock over the next decade as in the last, is asking too much. Severe competitive conditions and price cutting in the gypsum industry, a condition which was reflected in earnings in the last half of 1926, is still apparent and will have an important bearing on the earnings position of the company this year. As a matter of fact, Sewell L. Avery, president, at the last annual meeting of stockholders intimated that although this year may be satisfactory the earnings may not measure up to those of 1926. From a financial standpoint the company is better able to face this condition than many of its competitors. The management's policy in the past has taken care of that. Expenditures for plant and equipment in recent years have resulted in a cutting down of manufacturing costs; in fact, a 6% reduction in manufacturing costs in 1926 enabled the company to make the good showing it did.

Recent developments are indicative of a maintenance of the old policy with respect to dividend payments. Stockholders were asked to approve an increase in the authorized common stock from $15,000,000 to $25,000,000, and this they did. Ostensibly, the increased authorization was to provide for further stock dividends. This action was followed by the declaration of the usual quarterly cash dividend of 2%, or 40 cents a share.

From the foregoing facts, United States Gypsum Co. 7% cumlative preferred stock, of which there was $8,441,600 outstanding at the end of 1926, is a sound investment. It has a record of an unusually large margin of earnings above dividend requirements—$103.30 a share was earned on the preferred in 1926 and $101.56 in 1925.

As to the status of the common stock, the situation is much more complicated. As matters now stand, U. S. Gypsum common, to provide any reasonable return, must be held over a period of years. Therefore, it has become known as a rich man's investment; that is, it provides a small immediate cash return and the possibility of a building up of the investment by the time there has been a substantial reduction in income taxes. Any deviation from the present dividend policy of the management, of course, would change the situation with respect to the common stock.

Earnings of Rockland-Rockport Lime and Subsidiaries

THE data below are offered as a supplement to the annual report of the Rockland and Rockport Lime Corp., published in Rock Products, March 5 issue. The tabulation gives the earnings of the Rockland subsidiaries, namely the Hoosac Valley Lime Corp., Lime Rock Railroad and the Rockland Transportation Co.

Dolese and Shepard Net Increases

ALTHOUGH income from stone sales decreased last year, Dolese & Shepard Co. showed an increase in net through gains in earnings from other sources, disclosing the equivalent of $13.78 earned on capital stock compared with $13.53 in 1925. Concerning the year's business, President J. F. Talbot said:

"Prospects for 1927 indicate greater prosperity than we experienced during 1926. We base our prediction on the expenditure of the $100,000,000 Illinois state bond issue for roads, on the continued building prospects and the increased demand for agricultural limestone. During the year our property at School Street was sold for $27,000, a profit of $2,000 on book value. Our plant at Gary is in excellent shape, kept so by making replacements when necessary. The only additional equipment was a dragline used for stripping purposes, which cost $27,000. All outstanding bonds, $170,000, were paid on April 1, 1926. We paid in dividends during the year $162,758 and have invested in Chicago and Illinois securities $150,000."

INCOME ACCOUNT

	1926	1925
Operating revenues	$857,411	$876,701
Operating expenses	562,373	570,780
Net operating revenue	$295,038	$305,921
Other income	12,511	1,949
Gross income	$307,550	$307,870
Bond int., fed. taxes	43,654	48,781
Net income	$263,895	$259,088

ASSETS

	1926	1925
Cash	$70,496	$162,753
Marketable Sec. at cost	150,242	.....
Notes receivable	14,023	54,675
Accounts receivable	75,030	84,691
Accrued int. receivable	2,149	.....
Inventories	67,631	44,098
Prepaid expenses	3,117	3,610
Mort. note due Dec. 31, 1931	16,785	.....
Plant, equipment	1,065,148	$1,040,255
Res. depreciation	601,549	562,297
Net plant, equip.	$463,598	$477,957
Real estate, quarries	615,513	670,719
Furniture, fixtures	2,849	.....
Total	$1,481,437	$1,498,507

LIABILITIES

Accounts payable	$18,276	$19,550
Divs. payable Jan. 1	57,444	28,803
Bond interest	.....	2,550
Local taxes	9,643	9,687
Res. fed. tax	62,020	35,000
Bonds paid April 1	.....	170,000
Capital stock	957,400	957,400
Surplus Dec. 31	376,653	275,515
Total	$1,481,437	$1,498,507

PROFIT AND LOSS STATEMENT, ROCKLAND-ROCKPORT LIME CORP. (INCLUDING SUBSIDIARIES)

(Year Ending December 31, 1926)

	Rockland & Rockport Lime Corp.	Hoosac Valley Lime Co., Inc.	Lime Rock Railroad Co.	Rockland Transportation Co.	Total
Gross income	$1,635,787	$152,387	$137,750	$60,000	$1,985,923
Operating expense	1,424,372	134,523	107,581	15,478	1,681,954
Net operating profit	$ 211,415	$ 17,864	$ 30,169	$44,522	$ 303,970
Other income (net)	24,354	Dr. 566	Dr. 1,732	Dr. 1,119	20,938
Int., deprn. and Federal taxes	99,002	4,666	19,041	24,662	147,371
Dividends paid	96,828	.....	.....	9,000	105,828
Surplus	$ 39,940	$ 12,632	$ 9,395	$ 9,742	$ 71,709
Miscelaneous deductions	22,178	.....	Cr. 60	Cr. 289	21,829
Surplus Jan. 1, 1926	468,245	78,213	125,330	11,430	683,217
Surplus Dec. 31, 1926	$ 486,006	$ 90,846	$134,785	$21,461	$ 733,097

—*Financial Chronicle.*

Traffic and Transportation

EDWIN BROOKER, Consulting Transportation and Traffic Expert
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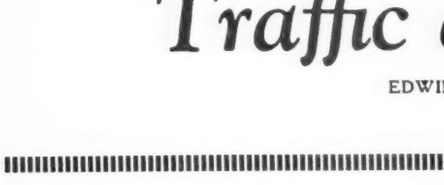


Car Loadings of Sand and Gravel, Stone and Limestone Flux

THE following are the weekly car loadings of sand and gravel, crushed stone and limestone flux (by railroad districts), as reported by the Car Service Division, American Railway Association, Washington, D. C.:

CAR LOADINGS OF SAND, GRAVEL, STONE AND LIMESTONE FLUX

District	Limestone Flux Week ended Feb. 12	Limestone Flux Week ended Feb. 19	Sand, Stone and Gravel Week ended Feb. 12	Sand, Stone and Gravel Week ended Feb. 19
Eastern	2,089	2,261	1,470	1,638
Allegheny	3,459	2,940	2,729	2,651
Pocahontas	148	149	442	391
Southern	446	490	9,669	8,889
Northwestern	740	1,000	2,576	2,478
Central Western	380	385	5,218	4,030
Southwestern	248	349	3,584	3,688
Total	7,510	7,574	25,688	23,765

COMPARATIVE TOTAL LOADINGS, 1926 AND 1927

	1926	1927
Limestone flux	*70,736*	*57,536*
Sand, stone and gravel	*161,359*	*186,128*

CENTRAL FREIGHT ASSOCIATION DOCKET

15120. **Sand and gravel,** lake, river and bank, other than sand loam, carloads, Michigan City, Ind., to Ironton, O. Present rate, 315c per net ton; proposed, 290c per net ton.

15141. **Crushed stone,** carloads, East Liberty, O., to Urbana, O. Present rate, 80c per net ton; proposed, 70c per net ton.

15145. **Dolomite,** raw or crude, and stone, fluxing, carloads, Martin, O., to Cincinnati and Hamilton, O. Present rate, 202c per gross ton; proposed, 176c per gross ton.

15151. **Crushed stone,** carloads, East Liberty, O., to Catawba and Mechanicsburg, O. Present rate, 80c per net ton; proposed, 75c per net ton.

15159. **Sand** (other than blast, engine, foundry, glass, molding or silica), gravel and crushed stone, carloads, Whartons, Ind., to Benton Harbor, St. Joseph and Stevensville, Mich. Route: Via N. J. I. & I. R. R., Pine, Ind.; Wabash Ry., Magee, Ind., and P. M. Ry. Proposed, 102c per net ton.

15160. To establish rate of 90c per net ton on **crushed stone,** carloads, Melvin, O., to Omega and Waverly, O. Present rate, 6th class.

15163. To establish on **stone, broken or crushed;** granite, crushed, in gondola cars, carloads, Milwaukee, Wis., via car ferry to Mt. Clemens and Port Huron, Mich., rate of 176c per net ton, to apply only on shipments originating west of the west bank of Lake Michigan from which no joint through rates are in effect. Present rate, 190c per net ton.

15164. To establish rate of 63c per net ton on **sand and gravel,** carloads, Ft. Jefferson, O., to Union City, Ind. (D. & U. R. R.). Present rates, 6th class.

15176. To establish on **gravel and sand,** other than blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing loam, molding or silica, carloads, Ambridge, Baden, Freedom and Rochester, Penn., to Indiana, Penn., rate of 135c per net ton. Present rates, 17c from Ambridge, Penn., and 18c from other origin points.

SOUTHWESTERN FREIGHT BUREAU DOCKET

11363. **Lime,** from Woodville, O., to Oklahoma points. To amend Item 2538 of S. W. L. Tariff 15M, applying on lime, common, hydrated, quick or slaked, carloads, minimum weight 30,000 lb., to points in Oklahoma by providing an arbitrary of 22½c per 100 lb. from Woodville, O., to East St. Louis, Ill. Also to amend Item 3012 of the tariff referred to by providing for an arbitrary of 16c per 100 lb. from Woodville, O., to Chicago, Ill. Interested shippers have requested that the arbitraries be reduced to the basis of the proportional rates, as they feel that they are entitled to such lower proportional rates when figuring on movement to Oklahoma points.

11381. **Oyster shells,** from New Orleans and points taking same rates to Liberal, Kan. To establish a rate of 41½c per 100 lb. on oyster shells, crushed or ground, as described in Item 1860 of W. T. L. Tariff No. 106F, from New Orleans and points taking same rates to Liberal, Kan.

The proposed rate of 41½c is applicable from Berwick, La., as published in S. W. L. Tariff 38 series, and since New Orleans and Berwick are generally on the same basis with regard to the rates on oyster shells, and it is felt that shippers' request is reasonable.

11494. **Silica,** from Little Rock, Ark., to Port Arthur, Tex. To establish rates of 31c per 100 lb. on silica, carloads, minimum weight 40,000 lb., from Little Rock, Ark., to Port Arthur, Tex. It is desired to publish the Texarkana, Ark., combination as a through rate.

11504. **Lime,** from points in Missouri to Decatur, Ill. To establish rate of 10½c per 100 lb. on lime, carloads, minimum weight 60,000 lb., from Glen Park, Brickeys, Byers, Mincke, Ste. Genevieve and Moser, Mo., to Decatur, Ill. The above rate, it is stated, is necessary in order that shippers may meet competition.

ILLINOIS FREIGHT ASSOCIATION DOCKET

4024. **Sand and gravel,** carloads, minimum weight 90% of marked capacity of car, except when loaded to full visible capacity actual weight will apply, per ton of 2000 lb., from St. Louis, Mo., to East St. Louis, Ill., to Pittsburg and Paulton, Ill. Present rate, $2.30 per net ton; proposed, $1.12 per net ton.

TRUNK LINE ASSOCIATION DOCKET

14773. **Lime** (calcium), carbonate of, recarbonated waste (whiting substitute), (precipitated lime), carloads, minimum weight 50,000 lb., from Luke, Md., to New York, N. Y., 18c per 100 lb. Reason—Rates are fairly comparable with others on like commodity from and to points in the same general territory.

WESTERN TRUNK LINE DOCKET

3281A. **Lime,** minimum weight 40,000 lb., from Chicago, Peoria, St. Louis, etc., to all C. B. & Q. R. R. points, Cheyenne, Wyo., to Willard, Colo., inclusive, and all Union Pacific R. R. points, Smeed, Nebr., to Sidney, Nebr., inclusive. Present—Class C, minimum weight 30,000 lb. Proposed—Make Item 2990E of W. T. L. Tariff 111E applicable to Cheyenne, Wyo. This item at present applies only to points of destination in Colorado. Add C. B. & Q. stations, Altvan, Wyo., to Willard, Colo., inclusive, and Union Pacific stations, Smeed, Nebr., to Sidney, Nebr., inclusive, to Item 170C of W. T. L. Tariff 78C.

5369A. **Sand and gravel** and sandpit strippings, minimum weight 90% of marked capacity of car, except that when weight of shipment loaded to full visible capacity of car is less than 90% of marked capacity the actual weight will apply, but in no case shall the minimum weight be less than 40,000 lb., from Kansas producing points to Missouri destinations. Present and proposed rates to a few representative points which are as follows: From Grinter, Morris, Muncie, Holliday, Kan., Lawrence, Kan., Turner, Woodson Spur, Kan., Zarah Kan. (rates in cents per net ton):

To—	Distance Note A	Pres. Note B	Prop. Note C
Birmingham, Mo.	13	70	90
Lawson, Mo.	39.7	80	90
Chillicothe, Mo.	86.5	*110	130
Powersville, Mo.	142.9	140	160

To—	Distance Note A	Pres.	Prop. Note D
Birmingham, Mo.	13	80	100
Lawson, Mo.	39.7	90	100
Chillicothe, Mo.	86.5	132	140
Powersville, Mo.	142.5	150	170

To—	Distance Note A	Pres.	Prop. Note E
Birmingham, Mo.	13	90	110
Lawson, Mo.	39.7	100	110
Chillicothe, Mo.	86.5	*130	150
Powersville, Mo.	142.9	160	180

Note A—C. M. & St. P. distance from Kansas City used.

Note B—Tariff authority C. M. & St. P. 9805-I, I. C. C. B5070.

Note C—Basis Nebraska joint scale subject to Kansas scale as minimum.

Note D—Basis 10c over Turner, etc., rates, authorized by W. T. L. Rate Advice 6330.

Note E—Basis 20c over Turner, etc., rates, prescribed by I. C. C. by order in Docket 15715, dated Nov. 26, 1926.

*Present Turner, etc., rate in error, as W. T. L. Rate Advice 7025 authorized $1.22 net ton rate to Chillicothe, which would also have to be published to Sturges and Chula. Lawrence, Kan., rate wrong; should be 20c over proper Turner rate of $1.42 net ton.

SOUTHERN FREIGHT ASSOCIATION DOCKET

32372. **Sand and gravel** from Hattiesburg and Lumberton, Miss., to N. O. & N. E. R. R. stations. It is proposed to establish the following reduced rates on sand and gravel, carloads, from Hattiesburg and Lumberton, Miss.: To Pearl River, St. Joe, Alton and Slidell, La., 70c; to Salmens, Guzman and North Shore, La., 80c; to South Point, Little Woods, Edgelake, Seabrook, New Orleans and Port Chalmette, La., 83c per net ton—made with relation to rates from points on the N. O. G. N. R. R. The proposed rates to be subject to the following commodity descriptions: To Pearl River, St. Joe, Alton, Slidell, Salmens, Guzman and North Shore, La.: Sand and gravel, straight or mixed carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern. To other points: Sand and gravel, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern.

32377. **Crushed stone,** from Rocky Point, Indian Rock and Eagle Mountain, Va., to North Carolina points. It is proposed to establish the following reduced rates on stone, crushed, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight shall govern, from the origins mentioned above (in cents per net ton):

To—	
A. C. L. R. R.	
Washington, N. C.	189
W. & V. R. R.	
Wilford, N. C.	194
Vandemere, N. C.	194
East Carolina R. R.	
West Tarboro, N. C.	219
Henrietta, N. C.	219
Davistown, N. C.	219
Pinetop, N. C.	219
S. A. I. R. R. and A. C. L. R. R.	
Lumberton, N. C.	212

The rates proposed are the same as approved under Submittal No. 29919 from Klotz, Va.

32433. **Talc** from Chatsworth, Ga., to Norfolk, Va. It is proposed to establish rate of 77c per 100 lb. on talc, viz.: Pencils, crayons, blanks or cubes, packed, less than carloads, from Chatsworth, Ga., to Norfolk, Va., same as rate suggested under Submittal 31637, from Chatsworth, Ga., to Newport News, Va.

32482. **Marble or stone, crushed,** from Whitestone, Ga., to Houston-Galveston, Tex. It is proposed to revise the existing rate on marble or stone, crushed, carloads, from Whitestone, Ga., to Houston and Galveston, Tex., to basis of New Orleans, La.-Logansport, La., combination, account of the Interstate Commerce Commission's informal ruling that rates based on Sabine River, La.-Tex., combination are improper. The existing rates are published in Item 6564, Agent Johanson's I. C. C. 1906, and reflect New Orleans, La.-Sabine River, La.-Tex., combination. Present and proposed rates are as follows: To Houston, Tex., present 630c, proposed, 730c per net ton; to Galveston, Tex., present 640c, proposed 740 cents per net ton. The proposed rates to be subject to the following commodity description: "Marble or stone, crushed, carloads, minimum weight 90% of the marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern, at 280c per net ton, and minimum weight of 80,000 lb., or marked capacity of car; when capacity of car is less than 80,000 lb., at 290c per net ton and minimum weight of 50,000 lb., or marked capacity of car when capacity is less than 50,000 lb., at balance of rate."

32483. **Limestone, ground,** from Cartersville, Ga., to Houston and Galveston, Tex. It is proposed to revise existing rates on ground limestone, carloads, from Cartersville, Ga., to Houston and Galveston, Tex., to basis of Vicksburg, Miss.-Shreveport, La., combination, account of the Interstate Commerce Commission's informal ruling that rates based on Sabine River, La.-Tex., combination are improper. The existing rates are published in Item 5834, Agent Johanson's I. C. C. 1906, and reflect New Orleans, La.-Sabine River, La.-Tex., combination. Present and proposed rates are as follows: To Houston, present 611c, proposed, 621c per net ton; to Galveston, Tex., present 621c, proposed 651c per net ton. The proposed rates to be subject to the following commodity description: "Ground limestone, carloads, minimum weight marked capacity of car, except when car is loaded to visible capacity actual weight will govern, at 261c per net ton, and 80,000 lb., or marked capacity of car if less than 80,000 lb., at 190c per net ton, plus 50,000 lb., or marked capacity of car, if less than 50,000 lb., at balance of rate."

32493. **Stone or slate,** crushed or pulverized, from Bolivar, Fairmont and Whitestone, Ga., to Gaffney, S. C. Class or combination rates now apply. It is proposed to establish the following commodity rates on: Stone or slate, crushed, minimum weight capacity of car, but not less than 60,000 lb., carloads; stone or slate, pulverized, minimum weight capacity of car, but not less than 60,000 lb., carloads: from the origins mentioned above to Gaffney, S. C.: On crushed stone or slate, 221c; on pulverized stone or slate, 230c per net ton. The proposed rates are the same as in effect to Gastonia, N. C., from these points.

32497. **Stone,** broken or crushed, from Dolcito, Ala., to Boyles, Ala. Present rate, 70c per net ton. Proposed intrastate rate on: Stone, broken or crushed, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern; from Dolcito to Boyles, Ala., 50c per net ton, same as rate to North Birmingham, Ala.

32499. **Scrap mica** from New England points to Asheville, Biltmore, Elk Mountain, Craggy and Munford, N. C.; cancellation. Page 101, Agent Cottrell's I. C. C. 589, publishes on mica, scrap, carloads, minimum weight 40,000 lb., from Cardigan, N. H., and Newton Falls, Mass., to Asheville, Biltmore and Elk Mountain, N. C., 52c per 100 lb. Page 22, Supplement 11, Agent Cottrell's I. C. C. 589, publishes on mica, scrap, carloads, minimum weight 40,000 lb., from Boston, Mass., Providence, R. I., and points taking same rates, to Craggy and Munford, N. C., 52c per 100 lb. It is proposed to cancel these commodity rates, account of no movement, and permit class rates to apply. The proposed cancellation, however, not to affect the rate recently approved under Submittal 30832, on crude or scrap mica from Boston, Mass., Providence, R. I., and Rate Basis 1 points to Biltmore, N. C.

32591. **Gravel** from Hazen and Orrville, Ala., to Thomaston, Hugo, Muskwa and Linden, Ala. It is proposed to establish the following reduced rates on gravel, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern, from Hazen and Orrville, Ala.: To Thomaston, Ala., from Hazen, Ala., 68c; from Orrville, 63c. To Hugo, Ala., from Hazen, 72c; from Orrville, 68c; to Huskwa, from both points, 72c; to Linden, Ala., from Hazen, 77c; from Orrville, 72c per net ton.

Federal Court Denies Slag Relief from I. C. C. Decisions

THE practical impossibility of a shipper obtaining relief in court from an adverse order of the Interstate Commerce Commission was demonstrated February 14 in the United States District court at Chicago, Circuit Judges Alschuler and Anderson and District Judge Wilkerson sitting en banc.

After an argument of about two hours, the court denied the petition of the Illinois Slag and Ballast Co., presented by George P. Boyle, for an interlocutory injunction restraining the operation of orders of the commission and the Illinois commission and the application of rates thereunder by some 40 railroads.

The orders of both commissions, effective at midnight on February 14, were the result of joint hearings in Chicago Gravel Co. et al. vs. A. T. & S. F. et al., Docket 17817, and proceedings consolidated therewith. These proceedings related chiefly to the sand, gravel and crushed stone rates applying within, into and around the so-called Chicago-Gary district. The chief controversy was as to the relation of the rates between points within the district to the rates from producing points outside the district to points in the district; also, the relationship the rates from the several outside zones should bear to each other in their rates to Chicago-Gary. The orders of the commission fixed all of these rates and, in addition, required the rates on slag to be increased to the sand, gravel and crushed stone figure. This increased the slag rates from Joliet about 70%. The Illinois Slag and Ballast Co, the only slag crusher in that territory, early in January petitioned both commissions for a stay of the operation of that portion of the orders relating to slag from Joliet for a reopening of the proceedings and for a hearing. It represented that the several complaints did not attack the slag rates, that no tariff or pleading of the carriers proposed to increase them, and that, therefore, it had taken no part in the proceedings. The commission granted the petition for reopening, restricted to a hearing on the slag rates, but refused to stay the operation of its order increasing those rates. Tariffs accordingly were filed, on 10 days' notice, effective at midnight, February 14.

The bill filed in the district court sought to enjoin the orders on the ground that the slag rates were not in issue and that, therefore, the commissions were without jurisdiction to enter the orders. This necessitated an analysis of the original complaint, consisting of 36 printed pages. In an early paragraph it defined "mineral aggregates" to mean "sand, gravel, crushed stone, crushed stone screenings, and/or slag." The complainants all were producers of sand, gravel and crushed stone in what is termed Zone 1 and Zone 2 territory. Joliet is in Zone 1.

Before the court, Mr. Boyle argued that the complaint, read by sections or taken in its entirety, did not attack the slag rates. In support of this contention, attention was directed to the fact that the complainants alleged their competition to be with producers in territories other than Zones 1 and 2 and that all the allegations of preference and prejudice were directed at the producers in the other zones or districts; that none of these were slag shippers, and that, therefore, both as to commodity and as to locality the Joliet slag rates were not involved.

Under a heading, "unreasonable rates to Chicago district," however, the complaint alleged that the rates on "mineral aggregates from Zones 1 and 2 producing points in interstate commerce to destinations in the Chicago district have been in the past, and are now and in the future, will be, unjust and unreasonable in violation of section 1 of the act to regulate commerce." Judge Anderson, by interrogatory and by direct statement, seemed of the opinion that this allegation placed the Joliet slag rates in issue for all purposes; that, under it, the mineral aggregate rates might be reduced or increased or the rates might be reduced on some of the constituent commodities and increased on others. Mr. Boyle argued that it was manifest that complainants were not contending that their rates on sand, gravel and crushed stone were too low and that, whatever construction of the phrase, "unjust and unreasonable," was logical and proper to apply to sand, gravel and crushed stone, likewise should be applied to slag. Judge Anderson thought otherwise and Judge Alschuler seemed doubtful. Judge Wilkerson called attention to one of the closing paragraphs in the prayer of the complaint reading as follows:

That the commission enter upon an investigation of the economic conditions surrounding the mineral aggregate industry, the conditions surrounding the transportation of mineral aggregates and the rates applied for and to the transportation of mineral aggregates in relation to the rates applied for and to the transportation of all other commodities by the defendants herein.

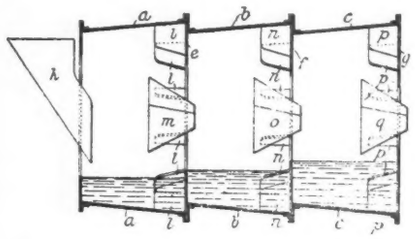
He indicated that this was sufficient to place the slag rates before the commissions.

In denying the application for an interlocutory injunction, the court, through Judge Alschuler, said it was of the opinion that the complaint, taken as a whole, was sufficient to place the Joliet slag rates in issue, and that, furthermore, inasmuch as the commission had reopened the case to hear the slag company, there was an adequate remedy at law by claim for reparation.

Irrespective of the adequacy of the reparation remedy, Mr. Boyle said, it would seem that shippers, to be entirely safe, will have to scrutinize carefully the wording of every complaint in which it is possible that their rates may be involved, even indirectly, and that lack of clarity and directness of expression will not be questioned, even though the gravamen of the complaint does not contemplate some rate obscurely included in some general language.

Current Abstracts of Foreign Literature

Sand Washing Device. The sand is fed into the machine shown through the spout *k*. Lifters, *b*, *n* and *p*, lift it out of the water and drop it on the cone frustrums *m*, *o* and *q*, thus passing it from one chamber to another and finally discharging it from the



machine in a dewatered condition. The water flows through the chambers in the opposite direction to the flow of the sand, giving a counter current effect.—*J. Southall, British Patent* 216,024.

Changes in Viscosity and Water Content of Cement Slurry. *Zement* of November 4 and 11, 1926, reprints a report made by Curt Prussing at the 1926 convention of German Portland Cement Manufacturers. The tests described in this report were inspired by a description of American methods of manufacture published by Dr. Muller, wherein a statement was made that at the Ford Motor Co.'s cement mill at Detroit, Mich., dextrine was regularly added to the slurry. This appeared to be of special interest to the author of these tests, as he had had experience with a shale which decreased the viscosity of the slurry.

The purpose of the tests was: (1) To find a practical method whereby the relative viscosity of the slurry could be expressed numerically; (2) To find means of regulating the viscosity of the slurry in the simplest way possible; (3) To find which constituents of the shale react with the admixtures.

To solve the latter problem hundreds of tests were made on synthetic mixtures made by combining colloidal silica, alumina and iron oxide in different proportions. The effect on the viscosity of the mass of alkaline admixtures such as soda, sodium hydroxide, calcium hydroxide and iron hydroxide was studied. It was found that the extent of oxidation of the iron constituents of the shale was of great influence on the viscosity of the mass produced by the addition of alkalies.

The author was faced with the problem of finding a device for measuring accurately the viscosity of the mass. The apparatus finally adopted, as a result of experimenting, was very similar to the familiar Vicat needle. It consisted of a glass cylinder, 30 mm. in diameter and 10 cm. high, to which was attached a graduated tube with a red mark etched on it. A 350 c.cm. container was filled with the sample and placed underneath in a flat dish which received the overflow. The glass cylinder and the graduated tube were filled with shot, as in the briquet testing machine. The cylinder was then allowed to descend into the sample until the red mark reached its surface, when the supply of shot was stopped. The weight of the shot required to produce this was a measure of the viscosity of the sample. In calibrating this apparatus, the red mark was made to correspond to the depth of descent of the empty cylinder in clear water.

An attempt was made to obtain a check on the procedure used at the Ford plant. A 1-liter sample of the slurry was thoroughly mixed with 0.25% (dry basis) dextrine. The viscosity of the latter required a cylinder weight of 270.7 gm., while the original sample required 301.8 gm. The following table gives a review of the results obtained:

Admixture of dextrine %	Weight of cylinder gm.
0.25	271
0.5	248
1.0	216

The same sample after being allowed to stand undisturbed for 48 hours gave the following results:

Admixture of dextrine %	Weight of cylinder gm.
1.0	210
2.0	165
3.0	163
4.0	162

The values of the weight indicate that the viscosity increases due to the admixture of dextrine, but evidently reaches a maximum at 2%.

To prove the purely colloidal nature of the process involved, further tests were made using the white of an egg as admixture. The results showed an effect similar to that of dextrine, though not as pronounced. Additional proof of this fact was obtained by using tannin to produce the opposite effect. It was thus established that the processes here studied come under the classification of colloidal processes, which, unfortunately, have not been given adequate attention thus far.

X-Ray Study of the Calcination Process. Studies of this subject were made by M. v. Laue, W. H. Bragg, W. L. Bragg, Debye and Scherer, Schibold, etc. Debye and Scherer developed a process for the examination of dense or earthy materials. The X-rays reveal the molecular structure of crystalline substances, showing the arrangement of atoms with great accuracy. Chemical reactions can thus be studied, such as a loss of water or carbon dioxide and as decompositions into a solid residue and volatile compounds. These reactions make up the calcination process. Gypsum is formed by partially driving off the water of the gypsum rock; lime is formed by the elimination of carbon dioxide; similar processes take place in the calcination of clay and cement. X-rays yield accurate analyses of all intermediate stages, as well as of the raw material and of the finished product.

It was thus found that no change of form takes place during calcination of lime, which is entirely a chemical reaction. Burning proceeds gradually, spreading over the surface somewhat like an etching process. In burning dolomite, the two constituents react independently, CaO being formed next to the MgO.

It is clear that a precise knowledge of changes of structures involved is of tremendous scientific importance.—*Tonindustries-Zeitung* (1927) **14,** 209.

Study of Properties of Plaster of Paris. Chassevent studied the setting properties of plaster of paris by measurement of the electrical conductivity of the solution forming in the immediate vicinity of the plaster and also by the heat changes involved. The anhydrous calcium sulphate prepared below 300 deg. F. on contact with water is transformed into the hemi-hydrate and forms a saturated solution which is supersaturated with respect to gypsum. The lower the temperature the greater the difference between the solubilities of the hemi-hydrate and gypsum. As setting commences the gypsum crystallizes out and heat is evolved.

A different form which rehydrates slowly is produced if anhydrous gypsum prepared above 300 deg. F. is used. A saturated solution of hemi-hydrate kept at a low temperature does not crystallize for 25 to 28 minutes. Setting is accelerated by the presence of gypsum nuclei in the original material or introduced by the addition of salts which increase the SO_4 ion concentration or by acids which do not cause a precipitate. Increasing amounts of added water decrease the density and strength of the plaster and generally make a poor plaster. *Bulletin Societe d'Encour* (1926), **125,** 789-803.

Gypsum Plaster. Pulverized gypsum is calcined and mixed with ground alum and rock nitre to form a slow setting plaster. *British Patent No.* 262,195.

Waterproof Mortar. A mixture of magnesium compounds and alkali silicates in colloidal form to which may be added water repellants, lime hydrate, fluorides or fluosilicates. *British Patent No.* 263,232.

Porous Concrete. Slag, coal or coke ash or other silicate containing materials which are low in lime and all of which have relatively low specific gravities are used as aggregate in making porous concrete of the type comprising portland cement, water and a gas generating metal powder. *British Patent No.* 243,308.

Arkansas Cement Project Revived

THE American Portland Cement Co. is reported to have revived a project to build a 2000-bbl. plant at Foreman, Ark., on the St. Louis and San Francisco Ry. The project includes a chalk-grinding mill for whiting and agricultural limestone. It is said the state of Arkansas will spend about $50,000,000 in the next few years on hard roads. C. E. Oxford, 245 W. 51st St., New York City, is managing director.

Cement and Concrete Products Producers Beware!

IN enumerating the competitors of common brick, in order of their importance, Secretary Stoddard mentioned concrete, poured or reinforced, lumber, and concrete products. He readily recommended ways to meet these competitions. To battle against the inroads made by concrete, engineering data should be assembled and used as a weapon, to meet the lumber competition sales effort should be employed and to battle concrete products both sales and engineering effort should be used. To consider any other product as competitor to common brick, said Mr. Stoddard, would be a waste of time.

It is very essential that brick manufacturers have a corps of salesmen, he remarked, to merchandise their product. A more persistent effort to sell brick will increase production to a point where it should be.

In closing his address Mr. Stoddard suggested the following points for consideration:

1. A repetition of the 6 cents dues with a provision for a graduating scale of dues of one cent additional each year until 10 cents is reached.

2. A resolve that more extensive selling effort be placed in the business. Every company should have at least one salesman.

3. Establishment of a fund (perhaps, outside of association dues) to study ways and means to reduce the cost in the wall.

4. A conscientious and wider use of Building Economy.

5. Better cooperation of organized manufacturer with dealer.

6. Adoption of uniform cost accounting system.

7. Uniformity in advertising.

—From a report of the annual convention of the Common Brick Manufacturers' Association in *Brick and Clay Record*. It will be interesting to sand-lime brick manufacturers to know that it should be considered a waste of time for clay brick manufacturers to look upon them as competitors. If that is true clay brick manufacturers have wasted a prodigious amount of time and effort and morality in the attention they have paid to sand-lime brick in the recent past—as in the Florida hurricane report!

Cement Section, National Safety Council, To Hold Kansas City Meeting

WHEN the First Annual Central States Safety Congress convenes at Kansas City, April 13, industrialists from the fifteen commonwealths between the Rockies and the Mississippi will have their first chance to get together and discuss common problems. This giant meeting is sponsored by the National and Kansas City Safety Councils and various regional bodies, and also includes public, home and school safety sessions. Opening with a general session April 13, there follows an industrial general session, at which these subjects will be presented: "Organizing the Plant for Safety," "Every Foreman a Safety Director," and "Keeping the Safety Committee Alive."

The Cement Section of the National Safety Council will be represented by a large delegation, and a special session for this group has been arranged April 14. W. S. Sabin, Portland Cement Association, will preside. H. G. Burgess, Kansas City Public Service Co., Kansas City, Mo., is to tell "How to Keep Men Interested in Their Own Safety." "Getting Men to Report for First Aid" is the subject of a speech by Harold R. Williams, Ash Grove Lime and Portland Cement Co., Kansas City, Mo. Major Harry A. Reninger, Lehigh Portland Cement Co., Allentown, Pa., speaking on "Fixing Accident Responsibility," will conclude the session.

All sessions affecting the Cement Section will be held at the Muehlebach Hotel. A special rate of one and one-half fares for the round trip on the "certificate plan" will apply for delegates attending the congress.

Portland Cement Association Opens New Office in Tennessee

A BRANCH OFFICE of the Portland Cement Association is being established in Johnson City, Tenn., and is in charge of John R. Overall of Nashville. The Johnson City territory is to be served by the Portland Cement Association from Johnson City as headquarters, such as are established only in large and growing centers; the association recognizing Johnson City as the center of the rapidly developing Upper East Tennessee section. For the present Mr. Overall may be reached at the offices of the Watauga Cement Products Corporation.—*Johnson City* (Tenn.) *Staff News.*

Rumors of Wyoming Cement Plant Persist

NEWSPAPER rumors of a projected portland cement plant at Laramie, Wyo., continue to come out. Thus far no rumor has hinted who the interested parties are.

Progress on the Valley Forge Cement Company Plant

GENERAL grading for plant site of the new Valley Forge Cement Co., at West Conshohocken, Penn., was started the first week of January, 1927, and soon after excavacation was commenced on the main buildings and machinery foundations, according to official information received by ROCK PRODUCTS.

The first unit of the plant will be of approximately 2300 bbl. per day capacity, and equipment for the first unit will consist of the following: One 48x60-in. jaw crusher for primary crushing, and a No. 9 hammer mill for secondary crushing. Clinker and rock storage will be 242 ft. in length and 80 ft. wide. A 15-ton traveling crane will be installed with a 3-yd. bucket.

Compartment mills of the Solo type, 7 ft. 3 in. diameter by 42 ft. 8 in. long, will be installed in both the wet and dry departments. The slurry will be handled from the wet mills by centrifugal pumps and from the finishing mills by the Fuller-Kinyon system.

Two 9-ft. kilns 223 ft. long with 11 ft. 10 in. burning zones will be installed. These kilns are of the Polysius Solo type and will be constructed by the Polysius Corporation of Bethlehem, Penn. Clinker from each kiln will be discharged into automatic scales discharging directly into the clinker storage.

The coal mill equipment consists of a 5 ft. 6 in. by 42 in. Fuller-Lehigh indirect-fired dryer and two 48-in. screen type Fuller-Lehigh pulverizer mills. The coal will be transported to the kiln bins by a Fuller-Kinyon system. Bailey type coal feeders will be used, which will record the weight of coal fired. This, together with the clinker scales and the scales on the raw material, will give the operators a continuous record of material being handled.

Power will be purchased from the Counties Gas and Electric Co. Switchboard and transformer equipment will be furnished by the Westinghouse Electric and Manufacturing Co., and all motors will be furnished by the General Electric Co.

National Survey of Building Needs Completed

THE ninth semi-annual survey of the building needs of the country has just been completed by the National Association of Real Estate Boards. The report of the survey shows that there is still some shortage of residences, apartments and business buildings. The shortage in the above three divisions has been diminishing at a rate that would tend to show that our needs are about filled. However, this year's shortage has not diminished at the same rate as in the past three years. Of the 304 communities reporting, a shortage is shown for single family dwellings in 29% of the reports, for apartments in 33% and for business buildings in 19%.—*National Bulletin* of the Association of Building Trades Employers.

Georgia Portland Cement Corp. Active

THE annual meeting of the stockholders of the Georgia Portland Cement Corp., held at the offices of the company, in the Southern Finance building, February 28, resulted in the election of several new directors of the organization, including Thos. J. Hamilton of Augusta, C. W. Skinner of Waynesboro, W. S. Preetorius of Statesboro, and J. B. Tarbutton and T. I. Harrison of Sandersville. Others continued on the board were J. Lee Hankinson of Augusta; L. H. Charbonnie, Augusta; John C. Hagler, Augusta, and Herbert C. Lorick, Augusta. It is understood that other directors will be named shortly.

The personnel of the directorate is considered by the stockholders to be one of the strongest that can be claimed by any organization in the Southeast. All the Augusta members are widely known business men here, while Messrs. Harrison and Tarbutton of Sandersville are men of large business interests and intensively interested in development work in the Southeast. Mr. Preetorius is a capitalist of Statesboro, with extensive business interests in that section of Georgia, and the same may be said of Mr. Skinner, the new member who comes on the board from Waynesboro. L. H. Charbonnie is prominent in Augusta business circles and a director of the Georgia Railroad Bank. H. C. Lorick is president of the Lorick & Vaiden agency, prominent insurance people, and Thomas J. Hamilton is president and editor of the *Augusta Chronicle* and a director of the Georgia and Florida railroad.

J. Lee Hankinson, who is also on the board of directors, was elected president of the Georgia Portland Cement Corp. He is also president of the Augusta Clay Products Co. and vice-president of the Georgia-Carolina Brick Co. and president of the Hankinson Brick Co., the Dunbar Brick Co. and the Augusta Face Brick Co.

John C. Hagler, elected vice-president of the Georgia Portland Cement Corp., is president of the Hagler Brick Co. and the Georgia-Carolina Brick Co., vice-president of the Augusta Clay Products Co. and the Dunbar Brick Co., and is a pioneer in the development of the clay, brick and tile industry in Georgia.

Henry W. Neill, secretary and treasurer, is auditor of the Georgia-Carolina Brick Co. and of the associated companies affiliated with the organization.

The Georgia Portland Cement Corp. was organized about a year ago and, it is stated, has been going steadily forward with its plans without interruption. The concern has acquired about a thousand acres of limestone, shale and clay lands, most of which is in the immediate vicinity of Sandersville, and it is proposed to construct a plant costing upward of $2,000,000, which will have an initial capacity of 3000 bbl. and an ultimate capacity of 4500 bbl., which will make an annual production of 1,500,000 bbl. The engineering work, which has been extensive, has been conducted by the H. K. Ferguson Co., construction engineers, of Cleveland, Ohio, and H. W. Kewish, expert cement engineer, in charge, and A. R. Mohr, assistant, has been on the ground here practically all the time. Numerous chemical tests have been made by the Pittsburgh Testing Laboratory and other recognized national authorities on cement making, and the raw material, found in vast quantities, is pronounced highly suitable for making the best grade of portland cement.

Tentative plans for the construction of the new plant have been prepared and it is the expectation of the officers and directors that plans may be consummated in the immediate future which will enable the actual construction work for the big plant to go forward without delay.

The company, while maintaining offices in the Southern Finance Corp. building now, is preparing to enlarge its quarters to meet the growing needs of the concern, and the entire 15th floor of the Southern Finance Corp. building will be occupied by the cement concern.—*Augusta* (Ga.) *Chronicle.*

New Florida Lime Project

WITH 20.9 acres of excellent limestone deposits, a new company, the Limestone Products, Inc., composed of local and outside capital, will within the next sixty days begin operating their first unit at Ocala, Fla., says the *Banner,* of that city.

The location of this new plant is on the Seaboard Air Line railway one mile due east of Santos, the site of large operations by the Ocala Lime Rock Co.

It was stated by an official of the company the following products would be placed on the market: road rock, agricultural lime, washed concrete aggregate in three sizes, barrel lime and hydrated lime.

"We will have six steel jacketed kilns, oil burners, 50 ft. in height," said an official.

"Our lime averages 99% pure calcium carbonate, which is recognized by lime experts as probably the highest average in the entire United States. In fact, there are only two or three spots that will register such a per cent.

"Before this lime was purchased it was thoroughly tested for sand-lime brick making, back-wall and finish coat plaster."

"I consider refined lime in its infancy," commented one of the proprietors of this new plant. "Furthermore, this class of business will last indefinitely, as the commodities will be in demand in an increasing way as the state grows."

It is understood that the plant will start off with some 30 men on its payroll.

J. Guy Hall, consulting engineer for five years with H. Miscampbell, Duluth, Minn., together with his brother, Ralph S. Hall, both lime men, are among those associated with the company.

New Great Lakes Cement Carrier

THE Huron Portland Cement Co., Detroit, Mich., through its subsidiary, the Huron Transportation Co., has begun construction of a new $1,000,000 self-unloading, bulk-cement carrier for Great Lakes service.

The over-all length of the new vessel will be 400 ft. with a beam of 60 ft. and a molded depth of 29 ft.; the carrying capacity will be about 7,500 tons.

Driving power will be provided by a triple expansion engine of approximately 2,000 hp. Three Scotch boilers 13 ft. in diameter and 11 ft. long will supply steam for the engine.

The steamer will be supplied with a modern conveyor system and auxiliaries for loading and unloading bulk cargoes of cement.

The new ship when delivered October 1 will operate between Alpena and other lake ports.

Rock Asphalt Promoters Fined $6,000

WILLIAM A. WHITE and Aud Lampton, formerly president and general manager, respectively, of the Continental Rock Asphalt co., at Big Clifty, Grayson county, Ky., were fined $3,000 each by Federal Judge Charles I. Dawson when they pleaded guilty to using the mails to defraud.

Post Office Inspector W. E. Greenaway, who investigated the record of the company after an involuntary petition in bankruptcy was filed against it in 1924, said investors in Kentucky, Tennessee and Missouri were defrauded of approximately $250,000.

Records show that White, Lampton and Joseph A. Waddle, former secretary-treasurer, who faces trial on a similar charge Friday, organized the company in 1921, saying it had $300,000 in capital stock. Most of the stock was sold to the public at from $50 to $150 a share, the investigation revealed.

The chief selling point used by the company, Mr. Greenaway said, was a statement that former Gov. Edwin P. Morrow had invested $10,000 in the company. A strong secondary "come-on" used in the letters was a claim that State Geologist W. R. Jillson, who, the company declared, had examined its property, had purchased $5,000 worth of shares. Mr. Greenaway said investigation showed the supposed investments by state officials to be purely mythical.

When the company was liquidated by a bankruptcy referee in 1925 it did not have sufficient assets to pay its debts. Following indictments in December, 1925, Mr. Greenaway traced White and Lampton to Kissimee, Fla., where he found them in the real estate business, he said.

United States Gypsum Co. to Operate Dairy Farm

THE United States Gypsum Co. at Oakfield, N. Y., will have the largest dairy business in the country, according to the plans laid out by the directory of the company, which concern controls hundreds of acres of farm lands, which had been unproductive and used only for the purpose of getting out the gypsum rock underneath them.

Jack Pope, the farm manager of the company, has been out West for the past two weeks buying cattle to stock the farms. He has full charge of the new enterprise.

At present the company has livestock on its tenant farms and sells milk to George Lesso, the Oakfield distributor, and to the Atlas Milk Products Co. of Elba. A building just south of the Stephens farm near the West Shore railroad underpass has been converted into a bottling and pasteurizing plant and new equipment has been purchased for the building.

The company owns all the stock on the tenant farms and will have 200 more head of cattle from the western states. The milk will be bottled at the farm and distributed to all the towns in the county.

This is a new experiment undertaken by the officials of the company to make the unproductive lands earn a revenue, and if the plan works in this county it will be tried in the other states where the gypsum company has mines.—*Rochester* (N. Y.) *Journal.*

New West Coast Plaster Board Plant

J. F. MAKOWSKI, president and general manager of the Perfection Plaster Board Co., Inc., Oakland, Calif., announces that the recently acquired plant at 762 Bear Street in West Oakland's manufacturing district is now in production. Specially designed machinery has been installed. The plant has a daily capacity of 50,000 sq. ft. of plaster wall board.

The new concern will engage in the manufacture of plaster wall board and plaster lath to be marketed under the trade name of "Perfection Plaster Board" and "Perfect Board Plaster Lath."

"We have installed special machinery of our own design at a cost in excess of $10,000," said Mr. Makowski. "Our method of manufacture will be exclusively our own, every sheet of Perfection Plaster Board will receive individual attention, and is guaranteed to be perfectly flat, without waves or cockles."

Makowski has been associated with the manufacture and marketing of wall board and plaster lath for the past 11 years and controls numerous patents used in the manufacture of these products.

This plant, the only one of its kind in the East Bay, will employ approximately 25 men.

The personnel of the company includes J. F. Makowski, president and general manager; B. Somers, vice-president; E. K. Rooker, secretary and treasurer — *Oakland* (Calif.) *Post-Enquirer.*

National Gypsum Company Opening New $1,000,000 Mill in Michigan

ACTIVITIES of the National Gypsum Co., which has its principal office in Buffalo, N. Y., were outlined by President Haggerty in a recent letter to stockholders in which he announced an addition to their Clarence, N. Y., wallboard plant had just been completed, increasing the output 50%. A second plant in Michigan representing an expenditure of about $1,000,000 is nearing completion and will be in operation April 1. Large plaster mills are also being constructed at both Clarence, N. Y., and National City, Mich.

"National mineral wallboard, one of our main products," reports Mr. Haggerty, "has surprised the industry as well as the dealer. Due to an entirely new manufacturing process, developed and exclusively controlled by National, it represents the outstanding achievement since the inception of the wallboard idea.

"Since we began operating at Clarence the New York plant has made profits every month, even in December and January, which months are ordinarily not profit-making months in the industry. Our volume has been growing; we are adding many new desirable accounts and all of our products and particularly National mineral wallboard are giving an excellent account of themselves in sale and use. Our dealers are enthusiastic about our proposition and as this enthusiasm is spreading to unsold accounts as well, our task of adding distribution is less difficult as we go along.

"We now have in the field to be served by the Michigan plant a competent force of salesmen doing advance work to provide business for that plant. This force will be increased as production grows. The combined business from the two plants will represent a large volume and our profits beginning with April should be very interesting.

"The company is in excellent financial condition, with no bank loans and a large cash balance drawing interest. When the two plants have been completed in their entirety this good financial condition will still maintain.

"Our profits from the start have been very much in excess of our preferred dividend requirements and with the second unit going into operation we should build real value into the common stock."

The first plant of the National Gypsum Co. at Clarence, N. Y., was put in operation only eight months ago.

Rock Asphalt Firms in Merger

THE world's largest producers of rock asphalt under one corporate management will be the result of a consolidation of rock asphalt properties in Kentucky and Alabama, according to announcement made at Louisville, Ky., recently.

The new corporation will be known as the United Rock Asphalt Co., with headquarters in the Inter-Southern building. William E. Massey is chairman of the board of directors of the new company.

Mr. Massey said that all the properties of the Rock Asphalt Co. of America, of which he is president, are going into the new company. Their new modern electrically equipped plant on Green River in Edmondson county, with a capacity of 2,000 tons a day, a plant at Black Rock, Ky., and one at Decatur, Ala., are in the new corporation. The three combined plants will have a capacity of 3,000 tons a day, which is said to be the world's largest production under one corporate management.

All these plants now have orders for their products which will keep them running for the next year, it was said.

The financial end of the consolidation of the properties was handled by Mr. Massey, who also is president of the Ryan-Hampton Tobacco Co., Louisville, Ky.; Eugene Massey, real estate man of Chicago; Howard F. Hansell, Jr., president of Frazier & Co., bankers and brokers, New York; Frank Finsthwait, of the firm of Finsthwait & Co., New York; H. J. Meehan, president, John C. Cosgrove, chairman, and J. E. Graham, treasurer, of the Cosgrove-Meehan Coal Co., Johnstown, Penn. Other Pennsylvania capitalists directly interested in the financing of the deal are W. F. Euwer, J. D. Kellar and Stephen Pohe, vice-presidents of the Public Service Co., and E. J. Bigley of Altoona, Penn.

Also it is said that a large amount of New York, Kentucky, Tennessee and Illinois capital is involved.

There will be 3,000,000 shares of preferred stock and 100,000 shares of no par common, it was said. The properties of the Rock Asphalt Company of America go in at $1,000,000 preferred and others at $350,000. Other financers will furnish operating capital.

Officers of the United Rock Asphalt Co. are president, Fred T. Fitzharris; secretary, Fred H. Mertens, and treasurer, J. D. Keller. A. C. Leathers is sales manager.

International Slag Combination

RECENT reports state that there is a possibility of the formation of a Thomas slag cartel to include producers in Belgium, France, Luxembourg, Sarre and Lorraine, representing a total annual capacity of 3,000,000 tons. The negotiations, it is said, would probably start under the auspices of the "Rohstahlgemeinschaft."

What Every Quarry Man Is Looking For!

THE following item from the *Durango* (Colo.) *Democrat* ought to excite the interest and curiosity of every live quarry operator!

"The county commissioners recently purchased a rock crusher from the H. W. Moore Hardware Co. of Denver. The claim is made that it is the only one in existence that conveys the rock in a single operation from the quarry direct to the loading bin."

Activity in the Indiana Oolithic Limestone Belt

OFFICIALS of stone companies at Bloomington, Ind., say that the present year will witness the greatest development which the stone belt of Indiana ever has known. As evidence to back this statement, they point to the core drilling which now is being carried on in different parts of the field.

While this core drilling is being done with some secrecy, it is known that the most promising results have been obtained and that at least six or eight new quarries and mills will be opened in and around Bloomington this year.

When the $40,000,000 stone merger was made, resulting in the organization of the big Indiana Limestone Co., nearly 100 widely known operators of the district were left without a business. It is some of these men who are core drilling and who are seeking to organize new companies to get back into the stone business. They are urged on by the fact that the stone business in the entire belt has been good and is getting better.

Officials of independent stone companies in the section report they have more business than they can get out and are turning down orders. One of the most active fields of core drilling is between Bloomington and Ellettsville. It is said some of the finest stone in the district is being discovered. Plans are being made for the organization of four separate companies to quarry stone from this section.

Holmes Safety Award Won by Louisville Cement Company

THE Speed, Ind., limestone quarry of the Louisville Cement Co. enjoys the unique distinction of being the only quarry to receive a certificate from the Holmes Safety Award Committee of the Joseph A. Holmes Safety Association, commemorating its operation over a long period of time with exceptional safety. No fatal accidents and no "lost-time" accidents occurred at this quarry during a period of more than two years from June 1, 1924, to December 31, 1926. A total of 545,497 man-hours, or 60,611 man-days, was worked at this quarry during this period.—*National Crushed Stone Association Bulletin.*

Projected Toledo Municipal Quarry Plant

A STONE-CRUSHING PLANT for the Welfare Farm, Toledo, Ohio, which was planned for early in 1927, will have to be postponed until the latter part of the year, as a result of technicalities in the state laws relative to the issuance of bonds by council.

The cause of the delay is due to a provision of the law which restricts the bonds that council can authorize in the first six months to 50% of the total that it may issue during the entire year.

The council's limit for 1927 is approximately $1,100,000, of which to date it has authorized $771,000, or $221,000 in excess of the 50% margin. The heads of the various departments, in co-operation with Mayor Mery, have been working on a plan to reduce the administration's program to comply with the state law, it was caid.—*Toledo* (Ohio) *Times.*

Dolomite Products Company, Rochester, N. Y., Brings in Gas Well

JOHN H. ODENBACH, president of the Dolomite Products Co., whose plant is just west of Rochester, N. Y., is receiving the congratulations of his many friends in the quarry industry; for natural gas has been discovered on his quarry property. It is the nearest natural gas to Rochester ever discovered. The Rochester *Democrat and Chronicle* describes the discovery as follows:

"In quarrying the rock approximately 60,000 gal. of water seeping into the quarry is pumped each hour. A hole 6 in. in diameter was being drilled by the company's employes, in charge of Harvey Clark, superintendent, and Joseph Moyer, chief driller, to provide drainage for the water, when Mr. Moyer, lighting a cigarette, tossed the match into a pool of water surrounding the drill. There was a flash of flames, and his eyelashes were singed. The flames burned in the water and there were a number of bubbles. He hurried to Mr. Odenbach, who took steps to control the gas.

"Recently George Keith, expert of the Churchville Oil and Gas Co., who has had years' experience in drilling gas producing wells, inspected the well and said the gas, forcing itself through 150 ft. of water, was escaping at a rate of 60,000 to 100,000 cu. ft. a day, and estimated the pressure at 100 lb. He estimated that when the water is taken from the hole the flow will be at a rate of from 100,000 to 200,000 cu. ft. a day, or more. He said this is greater than most wells drilled in established fields near Rochester.

"The closest natural gas has been discovered to Rochester, up to the time of the tapping of the pocket at the Dolomite property, is 12 miles.

"Mr. Odenbach said that he would drill other holes and that, if the flow continues as great, steps would be taken to utilize the gas as a fuel for the Dolomite plant, which will crush, when the installation of additional equipment is completed this spring, 3000 tons of stone a day, besides other by-products. He said fuel costs of the company approximate $20,000 a year, and that the gas may provide all that is necessary. It is possible, he said, the company will pipe the gas to farmhouses in the neighborhood. The Dolomite Products Co., Inc., owns 140 acres of land adjoining its plant.

Basic Products Co. Cement Plant to Begin Operation April 1

MANUFACTURE of Basic Portland Cement will begin at the Kenova plant of the Basic Products Co., before April 1, it was announced by A. T. Wood, general manager, at Kenova, W. Va.

Machinery for the wet department of the plant has been placed and has undergone thorough tests, Mr. Wood said. The installation, he said, was shown to be in perfect condition.

Grinding machinery in the dry department has been placed on its foundations, and final tests of its efficiency will be made within ten days.

Raw materials from the Kentucky mines of the company have begun arriving at the Kenova plant ready for the manufacturing process.

Announcement was made several months ago that the company had secured extensive deposits of limestone in Kentucky for the manufacture of cement.

Construction Work Soon on Volunteer Portland Cement Plant

ORGANIZATION of the Volunteer Portland Cement Corp. was completed recently at Knoxville, Tenn., and application has been filed for a charter. The firm has been incorporated for $1,000,000. Stock to the extent of $900,000 has already been subscribed, and the remainder of the $100,000 will be offered to Knoxville investors, as those backing the company prefer that the corporation be locally owned. In the event Knoxville people do not take this stock it will be taken by outside interests.

Officers of the company are: J. Ross Hanahan, president, and Howell J. Davis, vice-president. Local directors are: Weston M. Fulton, C. M. Moore and Howell J. Davis.

Work is expected to proceed at once. Temporary offices of the company will be located in the office of Mr. Davis in the Holston National Bank building.—*Knoxville* (Tenn.) *Journal.*

Howell J. Davis is president of the East Tennessee Coal Co., Knoxville. J. Ross Hanahan is a former cement manufacturer from Leeds, Ala.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Concrete Construction With New Type of Cement Block

IN several European countries, particularly Germany, the acute housing shortage in the past few years is rapidly being made up by advanced methods in concrete construction which entail the use of pre-cast units. A description of one of the systems used in Germany for residential construction of this type was published in ROCK PRODUCTS, May 1, 1926 issue. These houses are said to have required but one day for complete erection after the pre-cast unit has hardened.

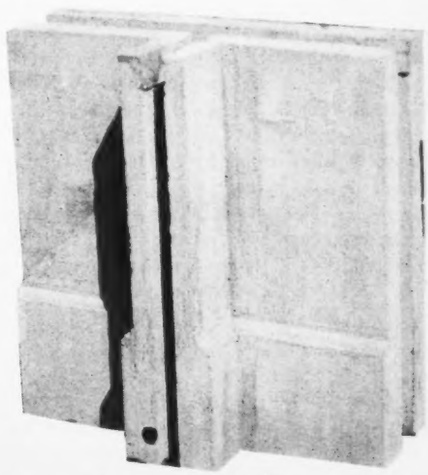
Somewhat similar methods have been developed in the United States and one of the most recent is that of Mano Cutayar, Arcadia, Fla. Mr Cutayar has invented a new type of tongued and grooved cement block by which he says houses can be economically built in mass production. Through its use he hopes to eliminate largely the costly skilled labor such as stone masons, carpenters, plasterers and painters. These houses, 5- and 6-room bungalows, are to be built of pre-cast units 24x36x8 in.

The following description is taken from Mr. Cutayar's patent application (U. S. No. 133,053):

This invention consists of artificial stones designed in such a way as to eliminate the skilled mason or bricklayer, outside stucco finish, the carpenter except for flooring, the plastering as it is ordinarily done and ordinary fire insurance. Further, the electrician's and plumber's bills are reduced over 40%.

Composition

This type of block consists of a cement mixture (1:2) to which a moisture proof formula is added. By a special way of casting a glossy surface is obtained, or a rock finish or a stucco finish. Also a veneer of one or two colors can be given to the surface, or an imitation of marble or granite, even mosaic if the design is simple and plain. The

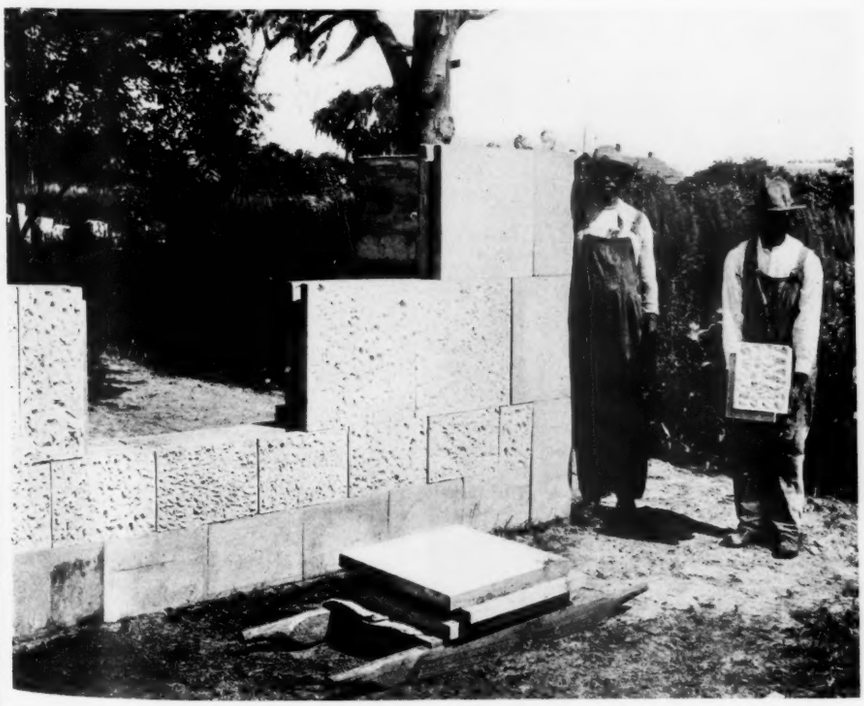


Pre-cast stone for partitions. The dimensions except thickness are the same as the outside stone

stone has a core of sawdust and shavings and other ingredients made fireproof and molded into a honey-combed block, tarred before it is placed in the form. This makes the stone relatively light, thus enabling us to make a standard stone 2 ft.x3 ft.x6 in., which naturally speeds up construction and cuts down work. Further, the core serves as a better insulator than the ordinary holow block, as among the ingredients there is a sound absorbent which makes the room almost soundproof.

Design of Stones

Most of the forms of the stones have two tongues diagonally opposite to two grooves. As the tongues are only one-eighth of an inch smaller then the grooves it follows that when the stone is laid it has no play, and



Laying up a wall with the special pre-cast block. Note the tongue and groove effect on the block lying on the truck

if the foundation is level and straight, the superstructure must be level and straight, and it does not require an expert to lay the stones. Every stone is marked in the factory with a letter and a number; i. e., all foundation stones are *A 1, A 2, A 3,* etc.; the course above it, *B 1, B 2,* etc.; the next, *C 1, C 2,* etc., until we come to the roof trimmings which are *H 1, H 2,* etc., for bungalows I have designed. The stones come in different shapes: corner stones; corner stones, T shaped for joining partitions to outside walls. The partition stones are of the same dimensions as the outside walls except that they are 4 in. thick instead of 6 in. There are stones for the doors and windows with outside and inside trimmings, and with plugged holes for screwing on hinges of doors and windows. Other stones carry a baseboard which can be cast in a different color from the rest of the stone. Still other stones carry grooves for the joists of the floor and the roof, which are slipped in thus eliminating all work of leveling and nailing. Other stones have holes in which pipes for waste, water and electricity are treaded. Also there are stones for the ceiling, which can have resettes or panels as desired in decoration. We also have stones for kitchen shelves, table and sink. All that forms a house is taken into consideration and manufactured by machinery that makes mass production cheap and efficient. Every house has corners, partitions, windows and doors and so forth. What makes one house differ from another is the way such parts are placed. Thus our houses will not be uniform or of one pattern. I have devised a stone which, while it is of the same design, varies in dimensions so that it can take care of every fraction left over from the 2 ft.x3 ft. stones. The stones are placed by eight builders who start from each corner working to the center of the wall, so that the fraction left is taken care of by such stones described above. We can afford to use eight workmen instead of two or three, as by this system we can use colored, unskilled labor, paying $3.50 a day.

Finishing

All the joints of the stones are made very exact even as they come from the wooden forms which we are now using; but they will be much more so when we use plaster or steel forms. The joints are mortared by a mixture of liquid cement which is shot into the grooves by an air compressor like sandblasting, only using a special nozzle that lets in just the necessary amount of liquid so that it will not ooze out and stain the surface of the wall. To this mixture a color matching the outside finish or contrasting with it if desired, is added. A special mixture of plaster, lime and other ingredients is used for plastering and is put on by an air brush which gives a rough, semi-rough or smooth finish; a color can be mixed so as to give a painted finish. I may add that I have designed a machine that can stipple in two or three colors, performing the work in one action.

Costs

The houses we build will be strong, substantial, sanitary, fireproof, insect proof. By our present methods the cost of building can be reduced by one third, and by mass production we can build a house 50% cheaper than it can be constructed of wood. A house of five rooms, bungalow type, can be cast in one day, as it has only 764 stones; the walls can be erected in three days, and the building finished in ten days. Such a house can be built for $2500.*

I have designed a machine, of which I am now making the blueprints, that can cast 50 stones at a time, give the desired finish, open the molds, carry the stones to the curing room, stack them according to their design and open the spray that wets them. But as the machine is only in design as yet, and the patent not yet applied for, I cannot make disclosures just now.

The pre-cast units are made in wooden forms of the type shown here. These forms will be replaced by others of steel or plaster when the manufacture gets well under way

Limestone Screenings for Concrete Products Manufacture†

By W. D. M. Allan
Portland Cement Association, Chicago, Ill.

THE concrete products business has developed very rapidly during the last five to six years. I think one of the most important factors that has aided the development is the general adoption of standard specifications throughout the country for concrete masonry units. We are fortunate, at this time, in having a standard specifications adopted or proposed by the United States Department of Commerce, Building Code Committee, the American Concrete Institute, the Underwriters' Laboratories, Inc., and the Building Officials Conference. Fortunately all of these organizations are in agreement in their strength and absorption requirements for concrete masonry units. All require that concrete block and building tile meet a 700 lb. per sq. in. gross area compression test, and that the absorption shall not exceed 10%.

Seven or eight years ago there were no standard specifications in effect and during this short period these specifications have been adopted.

In 1920 we estimate that there were about 50,000,000 concrete block and tile manufactured in the United States, and in quoting a few figures that I will give you I have reduced concrete block, brick and tile to the basis of concrete block, so

*Note by Mr. Cutayar: Since last year when these data were written, I found out that by reducing the number of forms from 122 to 47, I was able to cut the cost even to $1640, $1800 and $2000.

†From a paper read to the Detroit (1927) Convention of the National Crushed Stone Association.

that I am only mentioning one figure but having in mind the three units. From 50,000,000 in 1920 to about 700,000,000 in 1926 is the growth of that industry. Now what does that mean to the aggregate producers? It required about 10,000,000 cu. yd. of material to make these block, or about a quarter of a million carloads of material.

I believe crushed stone manufacturers or producers are interested in the concrete products business from two standpoints, a number of them are in the business themselves and a great many are selling screenings and small crushed stone to concrete products manufacturers.

Graded Limestone Screenings an Excellent Aggregate

In this discussion I am particularly interested in limestone screenings, and just to be a little more definite I am going to assume that these screenings will be graded about as follows, 5 to 10% retained on a ¼-in. screen and from 5 to 20% passing a 100-mesh screen. I know that in a good many communities the producers of crushed stone have found the concrete products market a very good one and in other communities producers of crushed stone manufacture concrete products. Sometimes the screenings are used about half and half with ⅜-in. crushed stone, and in other cases the screenings are mixed with coarse torpedo sand.

Limestone screenings in concrete block serve in general to make a lighter colored product, which in many markets is considered highly desirable, and they serve to make a more workable mix, that will stand rougher usage in moving the green product from the machine to the curing room. These two claims have been put forth by the users of crushed stone screenings as their principal advantages.

There is one distinction, I think, that should be borne in mind when considering limestone screenings in the concrete products field as compared with plastic concrete. In plastic concrete there is a tendency for any light fluctuant material to separate in strata or float to the top. In concrete for making masonry units that isn't true, for the reason that about 95% of all the products are made by the tamp process. Concrete must be of a rather stiff consistency spoken of commonly as semi-wet. There is no danger, in a mixture of this kind, for this fine material to separate. It remains uniformly distributed throughout the mass.

Precautions Necessary in Using Screenings

There are few precautions that have to be taken in consideration when using limestone screenings in concrete products plants. I think, in general, a little longer time of mix is needed when the screenings are used. That is especially true if the screenings are fine. There is a danger, if there is too much fine material in the screenings, that it will ball in the mixer and will not give a uniform mix throughout. So there is a happy medium that must be struck between a mix that is too fat, that will have a tendency to ball and a mix that is too harsh and have a tendency to break apart when the units are made. I believe that in general a five-minute mix should be recommended in concrete products plants, and in the promotion of limestone screenings in concrete products to the manufacturers I believe you should recommend this longer time of mix to insure a uniform quality of concrete. This isn't a hardship because there is a tendency throughout the concrete products field to increase the time of mix.

In some plants they have gone so far as to install two mixers, one above the other. In one the aggregates and cement are mixed dry for five minutes, and are then discharged into the second mixer, where they are mixed five minutes wet. It may not be necessary to carry the time of mixing this far, but certainly the five-minute mix is worth while.

It is claimed by those who used limestone screenings in the produtcion of concrete masonry that when the tampers fall on the concrete that it is more thoroughly compacted than if the material is too harsh.

Economics Possible in Products Manufacture

In this connection there is a very marked tendency among leading concrete products manufacturers to grade their materials in such a way that they can cut the material cost in their product to the very minimum. Frequently it means that manufacturers will get considerably more block from a sack of cement than they do under the present method. The Portland Cement Association has taken a broad gage view of that question. It would seem that when we assist a manufacturer to get 20 block to a sack of cement, where at the present time he is only getting 16 block, we are promoting in the wrong direction, but the thing we are practically interested in is to create the most favorable price differential for the concrete masonry materials.

There is a need in cleaner mixes for a material in the aggregate that has a plastic, fat, buttery effect. With a harsh aggregate and a lean mix block or tile are likely to be broken when put on a car to go into the steam curing room, webs are likely to crack and the corners fall down.

There are two ways to overcome this, one is to use richer mixes and the other is to select the materials that give the fat stickiness desired. It is simply a matter of dollars and cents for the manufacturer to decide which is the cheaper method.

Great Progress Recently Made in Products Manufacture

In connection with the making of concrete products great progress has been made. Machinery for efficient production of block is on the market. Equipment manufacturers are spending much time and research developing more efficient equipment, which in turn is attracting progressive, high grade products manufacturers into the business.

I had occasion, a few years ago, to make a trip through New York state inspecting the various concrete products plants as I came to them in each town. I visited 453 plants. In that bunch I found only five power equipped plants. At the present time if one would take the same trip he would have a hard time finding five hand tamp outfits. One manufacturer sold $1,000,000 worth of concrete products machinery last year and not a single hand machine was included. In five or six years' time the business has gotten away from hand machinery and is now in a class where power equipment is used almost universally.

Another indication of progress is the number of consolidations of small plants into large and efficient ones. In the city of Detroit there was recently perfected a large consolidation, and in Pittsburgn another. Five or six of the companies formed a million dollar concern. The new company will have an annual output of 8,000,000 block. Bigger and more efficient plants in the hands of better business men are lowering costs of production and are laying the proper amount of emphasis on sales organizations.

In certain sections of the country concrete products plants have been closed down because they were unable to meet competition. This has forced home the importance of efficient equipment and materials and has resulted in complete revamping of plants and proportions of aggregates.

Becoming a Large Scale Machine Operation

New plants are nearly all using automatic machinery. They are using large mixers, probably twice as large as they were a few years ago. This means more workable and stronger concrete. Nearly all are installing steam curing equipment to give uniform and complete curing of the product. Larger stocks of well cured block are stored in the yards to avoid the necessity of hauling products only a few days old which has resulted in excessive breakage and poor construction.

I believe the producers of crushed stone, especially those interested in using screenings such as I defined a few minutes ago, will find a good market among the con-

crete products manufacturers in many sections if they will make a study of the requirements of a good concrete products aggregate. Where present aggregates are too harsh I believe that the producers of crushed stone will find their best market among concrete products manufacturers.

Discussion of Mr. Allan's Paper

W. H. HOAGLAND (Columbus, Ohio): What do you think of the central concrete mixing plant?

Central Concrete-Mixing Plants

MR. ALLAN: In a good many sections central-mixing plants have met with success. It is largely a matter of merchandising. The feasibility of the idea and workability on the job all can be worked out nicely, but the question is largely one of getting the right kind of a selling and delivery plan that will be satisfactory to the local contractors.

JOHN STEPHENS (Hamilton, Ont.): With the central-mixing plant, what is the limit of time you can hold concrete out of forms?

MR. ALLAN: An hour may elapse without detrimental results. Some of the highway departments allow from 30 minutes to an hour after the concrete is mixed before it has to be placed.

MR. STEPHENS: What if you had a central-mixing plant in a yard and had to cover three miles?

MR. ALLAN: I think there is no danger there at all. I imagine you could haul from 15 to 20 miles over good roads.

The most important point in connection with centrally-mixed concrete is the question of the amount of water in the concrete. If the slump of the concrete is more than 4 in. the probability is you are going to have a separation of the material in the truck as you haul it to the job and that will be detrimental. If you have a relatively stiff concrete, such as is put in sidewalks, footings, mass work, and so forth, you will have no difficulty. You can keep your concrete stiff enough so that it is still workable and so that it will not separate.

At Danville, Ill., one of the contractors built quite a larger water-supply dam using concrete from a central-mixing plant, and he hauled it three or four miles, part of it over quite rough roads.

Accelerators in Products Manufacture

C. N. CONNOR (Washington, D. C.): Is there any tendency toward using accelerators to get a high early strength, or if admixtures are used to produce that buttery effect?

MR. ALLAN: Where dealing with harsh mixes, there is need for better workability. Most manufacturers get the desired workability through the proper selection of aggregates.

MR. CONNOR: On the high early strength is there a tendency to use admixtures like calcium chloride or similar products?

MR. ALLAN: Steam curing is used instead of admixtures to produce higher strength. Forty-eight hours of steam curing in a tunnel with a temperature of 100 deg. F. will enable you to put your block on the market within a very short time.

Some Essentials of Advertising and Publicity*

Educational Work Particularly Necessary

By W. J. Chandler

Advertising Manager, Lehigh Portland Cement Co., Allentown, Penn.

IN attempting to profitably discuss the value of advertising as it concerns a particular activity or industry, one must first make a close analysis of underlying conditions.

In considering the advertising of concrete products, is it not well to first ask the question—What are Concrete Products?

This seems like a very simple question to answer and yet, does the general public know what they are?

Before intimately discussing this question let us look at the subject from another angle.

Lumber, as you know, has been known to man as a building material for centuries. Everyone considering building thinks of lumber for a number of uses, and, in some instances, there are no satisfactory substitutes. Despite this fact, however, we see constant advertising activity on the part of such organizations as the California White and Sugar Pine Manufacturers, Red Cedar Lumber Manufacturers, Arkansas Oak Flooring Manufacturers, Idaho White Pine and Yellow Pine Association, American Walnut Manufacturing Association, and numerous other organizations and bureaus directly concerned in increasing the sale of lumber.

Established Reputations Must Be Maintained by Continuous Advertising

Here is evidence that despite the established reputation of lumber as building material, the lumber interests recognize the necessity of keeping this product sold to the public.

As another example of a building material favorably known to the public for thousands of years, we have clay brick.

Are the manufacturers of this product content with its general acceptance as a building material? No, they are not, and as evidence of the keen appreciation by these men of the power and economic value of advertising, let me direct your attention to the continual publicity work of such organizations as the American Face Brick Association, Common Brick Industry of America, National Paving Brick Manufacturing Association and many individual brick manufacturers throughout the country.

Clay tile has, as you know, been known for many years as a valuable material for construction work, but you find it being generously advertised to the public by the Associated Tile Manufacturers, Hollow Building Tile Association, National Terra Cotta Society and others.

Here we have products which are well and favorably known to architects, engineers, builders, contractors and the general public and still being vigorously advertised to keep them sold to the public and the building industry.

Greater Effort Required with Comparatively New Product

Let us now consider the problem which faces the manufacturers of concrete products. In the first place, these products have only come into the building field within the past 25 years. Is it reasonable to expect that in such a short space of time they could be expected to successfully compete with these other materials known for so many years and so well advertised, even if supported with elaborate and intensive advertising of an equal character?

During this period, what has happened to stimulate the demand for these products to result in the consumption of approximately 13,000,000 bbl. of portland cement in 1926, and the manufacture of 675,000,000 block alone?

As you know, there has been some very good publicity done by the Portland Cement Association, supported by the added publicity of a few cement manufacturers. This publicity has been of great assistance, but the surface has only been scratched.

One problem which has confronted this industry and is still a serious question, is that of insuring the manufacturer quality block to encourage future sales.

Production of Quality Product Essential

The success of the industry in the future demands a strict adherence on the part of the manufacturers to the production of quality products and active co-operation on the part of all concrete product associations in arranging their publicity to sell these new types

*Extracts from a paper read at the annual convention of the Wisconsin Concrete Products Association.

of building units to all men in the industry, and to the public generally.

In a survey of the field at the present time, one fact is obvious—the majority of manufacturers have been so closely following manufacturing activities that they have devoted little time to publicity. This has resulted in increased production, but not a corresponding increase in sales.

One solution to this problem would be for each manufacturer to estimate his production for a year and definitely decide to spend a certain sum for publicity to contribute to the stimulation of sales. Take for example a manufacturer who has an annual production of 200,000 block. If he were to set aside one cent per block for publicity purposes, it would permit him to use $2000, which would be a big aid in local advertising.

I have frequently heard manufacturers complain of local market conditions and the tendency to cut the price on block, but, on the other hand, there are many instances where manufacturers of quality block have devoted some time to informing the public of the quality of their block and have succeeded in getting a price above the market, which has been directly traceable to the intensive work which they have done in this connection.

Mediums for Advertising

Many block manufacturers today have available for their use splendid advertising material which is procurable from cement manufacturers and which, if used by them, can directly contribute to increasing their sales, and yet these helps are frequently overlooked by them.

The use of local newspaper advertising is one method of advertising which can be very successfully utilized at rather low cost, as papers in towns and cities outside of the metropolitan centers sell space at from 30 to 50c an inch, which would enable the manufacturer to run a series of advertisements throughout the year at a very modest figure.

The architects and contractors who come into touch with all new construction work are not generally informed of the merits of concrete building units, and the acquaintance of these men should be cultivated in each locality by the concrete products manufacturer in order that he may be assured of favorable consideration when any buildings are to be planned and built.

Educational Work with Contractors

During the past year I have been impressed with the lack of knowledge on the part of contractors as to how to bid on construction work where concrete block has been specified. They are hesitant about bidding on this type of construction and the real reason is they lack experience and have never been fully informed concerning the methods to be followed.

Here is educational work which must be done, not only by general publicity, but by personal work on the part of manufacturers in each community.

It seems to me that the problem is not one of bringing block above the ground through national advertising, but selling it for foundation construction as well as above ground.

If concrete products are economic building units for general construction work, and we are all convinced of this, the future is unlimited and the surface has only been scratched. The growth to date has resulted largely from the sheer merits of the product and not from any concerted effort on the part of men in the industry.

If manufacturers of these products are to succeed in having their products replace lumber, brick or clay products, it will only be by working whole-heartedly in a campaign which will bring their merits to the attention of the public at large, and to men in the building industry specifically.

Specific Recommendations

As a concluding thought let me leave with you these specific recommendations to guide you:

(1) Is your plant being operated on a sound, economical basis, and is the product you are manufacturing of a quality which will justify you in recommending it without reservations?

(2) If this be true, you owe it to your business and your future success to become identified with a progressive organization to enable you to keep abreast of the times and be prepared for future developments.

(3) With this as a basis, you should also subscribe to good trade publications and learn what your fellow competitors are doing.

(4) Your personal advertising plans should cover the following publicity methods for local use:

(a) Make the acquaintance of local architects, contractors and engineers.

(b) Plan a modest newspaper campaign, running ads once or twice a week, stressing periods when there is active building being planned.

(c) Decide on a good trade name for your products and devise a dignified letterhead and other business stationery.

(d) In certain sections billboard advertising can be utilized to good advantage.

(e) Make use of any good advertising material which is available from any association or any manufacturer.

(f) Plan a few good form letters which can be sent to a selected list of prospects with definite suggestions as to where your products can be used, satisfactorily and economically.

(g) Every time you sell material for any construction work, endeavor to erect a sign on such building sites and in this way tell the public your products are being used.

Your business is going to grow only in ratio to the efforts you put forward to stimulate sales.

The future for concrete products is almost unlimited. Whether you get your share or not depends on you.

Cement Pipe Plant for Columbia, S. C.

THE Superior Sewer Pipe Co., Inc., of Columbia and Greenville, S. C., expects to begin the construction of a plant on a site near Columbia and to begin the manufacture of its products at that plant, giving employment to about 35 men.

This concern manufactures concrete drainage pipe. It is owned and operated by C. R. Johnson of Anderson, S. C., and T. Keith Legare of Columbia. Mr. Johnson is president and treasurer and Mr. Legare is vice-president and sales manager.

The Superior Sewer Pipe Co. now has in operation one plant at Greenville, but in order to handle more advantageously its business in the central section of the state it was decided to erect a plant in Columbia.

The concrete pipe made by this concern is used extensively for sanitary sewers, storm drains and highway culverts, and is said to be manufactured with the latest type of concrete pipe machine. All standard sizes of pipe from 4 in. to 48 in. will be made by this company.

T. Keith Legare will be manager of the Columbia plant. He has made a special study of the manufacture and uses of concrete pipe for the past seven years.

New Cement Products Plant at Houston, Texas

INCORPORATION of a new manufacturing concern in Houston, Texas, with a capitalization of $20,200 to be known as the Pyramid Stone Co. to manufacture cast concrete stone for commercial construction purposes, was announced in that city recently. Incorporators of the firm are W. T. Carter, Jr., Gus C. Street, Jr., and James L. Shepherd, Jr. Mr. Street is president of the company.

A plant has been established in a building located at National and Center streets and operations are expected to start within the near future. Mr. Street has just returned from a business trip to Chicago where he made arrangements for employing skilled labor to do the work required.

The output of the new concern will be used in local building construction and several contracts for this material have already been obtained including the new bank building in Beaumont, the Jefferson theater in Beaumont and the Launch Club at Shoreacres.

The officials of the firm are well known business men of Houston.

Pittsburgh Products Makers Elect Officers

THE Pittsburgh Concrete Products Association elected the following officers recently: Grant Dibert, president; Edward Vero, vice-president; Frank Wilbert, Jr., treasurer; C. J. Herzog, secretary.

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., at producing point or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	⅜ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.30	1.30	1.30	1.30	1.30	1.30
Chaumont, N. Y.	.50	.....	1.75	1.50	1.50	1.50
Chazy, N. Y.	.75	.....	1.60	1.30	1.30	1.30
Coldwater, N. Y.—Dolomite			1.50 all sizes			
Danbury, Conn.	2.25	2.25	2.00	1.75	1.50	.....
Dundas, Ont.	.53	1.05	1.05	.90	.90	.90
Frederick, Md.	.50@ .75	1.20@1.30	1.15@1.25	1.10@1.15	1.10@1.15	1.05@1.10
Munns, N. Y.	1.00	1.50	1.50	1.40	1.25	1.25
Northern New Jersey	1.60	1.50@1.80	1.30@2.00	1.40@1.60	1.40@1.60	.....
Prospect, N. Y.	1.00	1.50	1.40	1.30	1.30	.....
Walford, Penn.	.70	.....	1.35h	.....	.....	.....
Watertown, N. Y.	1.00	.....	1.75	1.50	1.50	1.50
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL						
Alton, Ill.	1.85	.....	1.85	.....	.....	.....
Bloomville, Middlepoint, Dunkirk, Bellevue, Waterville, No. Baltimore, Holland, Kenton, New Paris, Ohio; Monroe, Mich.; Huntington, Bluffton, Ind.	1.00	1.10	1.10	1.00	1.00	1.00
Buffalo, Iowa	1.10	.....	1.50	1.30	1.35	1.35
Chasco, Ill.	1.00@1.30	.....	1.00@1.15	.....	1.00@1.15	.....
Columbia, Krause, Valmeyer, Ill.	1.10@1.50	1.10@1.25	1.20@1.35	1.10@1.35	1.10@1.35	‖1.25
Flux (Valmeyer)	1.10@1.50	.....	.....	1.75	.....	1.75
Greencastle, Ind.	1.25	1.25	1.15	1.05	.95	.95
Lannon, Wis.	.80	1.00	1.00	.90	.90	.90
Linwood and Buffalo, Ia.	1.10	.....	1.30	1.20	1.25	1.25
McCook, Ill.	1.00	1.25	1.25	1.25	1.25	1.25
River Rouge, Mich.	1.20	1.20	1.20	1.20	1.20	1.20
Montreal, Que.	.80	1.35	1.15	.90	.95	.95
Mt. Vernon, Ill.	1.10@1.20	1.00	1.00	1.00	1.00	.....
Sheboygan, Wis.	1.10	1.10	1.10	1.10	1.10	1.10
Toledo, Ohio	1.60	1.70	1.70	1.60	1.60	1.60
Toronto, Ont.	1.55	2.05	2.05	1.90	1.90	1.90
Stone City, Iowa	.75	.....	†1.10	1.05	1.00	.....
Waukesha, Wis.	.90	.90	.90	.90	.90	.90
Wisconsin Points	.50	.....	1.00	.90	.90	.....
SOUTHERN:						
Alderson, W. Va.	.50	1.45	1.35	1.30	1.25	1.20
Atlas, Ky.	.50	1.00	1.00	1.00	1.00	1.00
Brooksville, Fla.	.75	.....	2.65	2.65	2.40	2.00
Cartersville, Ga.	1.50	1.50	1.80	1.35	1.15	1.15
Chico, Tex.	1.00	1.35	1.25	1.20	1.10	1.00
El Paso, Tex.	1.00	1.00	1.00	1.00	.....	.....
Ft. Springs, W. Va.	.50	1.35	1.35	1.20	1.20	.....
Graystone, Ala.			Crusher run, 1.00 per ton			
Kendrick and Santos, Fla.			3½ in. and less, 1.00 per ton			
Ladds, Ga.	.....	.....	1.50	1.35	1.15	.....
New Braunfels, Tex.	.60	1.25	1.10	.90	.90	.90
Rocky Point, Va.	.50@ .75	1.40@1.60	1.30@1.40	1.15@1.35	1.10@1.20	1.00@1.05
WESTERN:						
Atchison, Kans.	.25	1.90	1.90	1.90	1.90	1.80
Blue Springs & Wymore, Neb.	.25	1.45	1.45	1.35c	1.25d	1.20
Kansas City, Mo.	.75	1.50	1.50	1.50	1.50	1.50
Rock Hill, St. Louis Co., Mo.	1.35	1.35	1.35	1.35	1.35	1.35

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	⅜ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.80	1.70	1.45	.....	.....	.....
Duluth, Minn.	.90	2.25	1.90	1.50	1.35	1.35
Dwight, Calif.	1.00	1.00	1.00	.90	.90	.....
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Tex.	2.50	2.00	1.55	1.35	1.25	.....
New Haven, New Britain, Meriden and Wallingford, Conn.	.80	1.70	1.45	1.20	1.05	.....
Northern New Jersey	1.70	2.20	2.00	1.60	1.60	.....
Oakland and El Cerito, Cal.	1.00	1.00	1.00	.90	.90	.....
Richmond, Calif.	.75	.....	1.00	1.00	1.00	.....
San Diego, Calif.	.....	2.75	2.55	2.35	2.35	.....
Springfield, N. J.	2.00	2.00	2.10	1.70	1.70	.....
Toronto, Ont.	.....	3.58@4.05	3.05@3.80	.....	.....	.....
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	1.10

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	⅜ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Berlin, Utley, Montello and Red Granite, Wis.—Granite	1.80	1.70	1.50	1.40	1.40	.....
Cayce, S. C.	.....	2.00	1.75	1.75	1.60	.....
Eastern, Penn.—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40
Eastern Penn.—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Emathla, Fla.			Crushed flint rock, 2.50 per cu. yd.			
Lithonia, Ga.	.75	1.60b	1.60f	1.40	1.30	1.25
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.50	.....
Middlebrook, Mo.	3.00@3.50	.....	2.00@2.25	2.00@2.25	.....	1.25@3.00
Richmond, Calif.—Quartzite	.75	.....	1.00	1.00	1.00	.....
Somerset, Penn. (sand-rock)			1.50 to 1.85			
Toccoa, Ga. (Granite)	.....	1.50	1.40	1.30	1.25	1.25

*Cubic yd. †1 in. and less. ‡Two grades. ‖Rip rap per ton. (a) Sand. (b) to ⅜ in. (c) 1 in., 1.40. (d) 2 in., 1.30 (e) Dust. (f) ¼ in. (h) less 10c discount. (i) 1 in., 1.40.

Agricultural Limestone

(Pulverized)

Alderson, W. Va. — Analysis, 90% $CaCO_3$; 50% thru 50 mesh	1.50
Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 90% thru 100 mesh	5.00
Asheville, N. C. — Analysis, 57% $CaCO_3$, 39% $MgCO_3$; 50% thru 100 mesh; 200-lb. burlap bag, 4.00; bulk	2.75
Atlas, Ky.—90% thru 100 mesh	2.00
50% thru 100 mesh	1.00
Bettendorf and Moline, Ill.—Analysis, $CaCO_3$, 97%; 2% $MgCO_3$; 50% thru 100 mesh, 1.50; 50% thru 4 mesh	1.50
Blackwater, Mo.—100% thru 4 mesh	1.00
Branchton and Osborne, Penn.—100% thru 20 mesh; 60% thru 100 mesh; 45% thru 200 mesh. (Less 50 cents commission to dealers)	5.00
Charleston, W. Va.—Marl, per ton, bulk	3.00
Chaumont, N. Y.—Pulverized limestone, bags, 4.00; bulk	2.50
Chico, Tex.—50% thru 50 mesh, 1.75; 50% thru 100 mesh	2.25
Colton, Calif.—Analysis 90% $CaCO_3$, bulk	4.00
Cypress, Ill.—90% thru 100 mesh	1.35
Ft. Springs, W. Va.—50% thru 4 mesh	1.50
Hillsville, Penn.—Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$; 75% thru 100 mesh; sacked	5.00
Hot Springs and Greensboro, N. C.—Analysis, $CaCO_3$, 98-99%; $MgCO_3$, 42%; pulverized; 67% thru 200 mesh, bags	3.95
Bulk	2.70
(Paving dust)—80% thru 200 mesh, bags	4.25@ 4.75
Bulk	3.00@ 3.50
Jamesville, N. Y.—Analysis, 89.25% $CaCO_3$; 5.25% $MgCO_3$; pulverized, bags, 4.25; bulk	2.75
Joliet, Ill.—90% thru 100-mesh	4.25
Knoxville, Tenn.—80% thru 100 mesh, bags, 3.95; bulk	2.70
80% thru 200 mesh, bags, 4.25; bulk	3.00
Ladds, Ga. — Analysis, $CaCO_3$, 58%; $MgCO_3$, 32%; pulverized; 50% thru 50 mesh	1.50
Marblehead, Ohio—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 60% thru 100 mesh; 70% thru 50 mesh; 100% thru 10 mesh; 80 lb. paper sacks, 5.00; bulk	3.50
Marlbrook, Va.—Marl, per ton, bulk	2.25
Marion, Va. — Analysis, 90% $CaCO_3$, pulverized, per ton	2.00
Middlebury, Vt. — $CaCO_3$, 99.05%; 50% thru 200 mesh; sacked	5.50
Milltown, Ind.—Analysis, 94.50% $CaCO_3$, 33% thru 50 mesh, 40% thru 50 mesh; bulk	1.35@ 1.60
Olive Hill, Ky.—90% thru 4 mesh	1.00
Piqua, Ohio—Total neutralizing power 95.3%; 99% thru 10, 60% thru 50; 50% thru 100	2.50@ 2.75
100% thru 10, 90% thru 50, 80% thru 100; bags, 5.10; bulk	3.60
99% thru 100, 85% thru 200; bags, 7.00; bulk	5.50
Rocky Point, Va.—Analysis, $CaCO_3$, 95%; 50% thru 200 mesh, burlap bags, 3.50; paper, 3.25; bulk	2.00
Syracuse, N. Y.—Analysis, 89% $CaCO_3$; $MgCO_3$, 4%; bags, 4.25; bulk	2.75
Toledo, Ohio, 30% through 50 mesh	2.25
Waukesha, Wis.—90% thru 100 mesh, 4.50; 50% thru 100 mesh	2.30
Watertown, N. Y.—Analysis, 96-99% $CaCO_3$; 50% thru 100 mesh; bags, 4.00; bulk	2.50
West Stockbridge, Mass. — Analysis 90% $CaCO_3$, 50% thru 100 mesh; cloth bags, 4.75; paper, 4.25; bulk	3.25

Agricultural Limestone

(Crushed)

Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 50% thru 4 mesh	3.00
Atlas, Ky.—90% thru 4 mesh	1.00
Bedford, Ind.—Analysis, 98.5% $CaCO_3$, 0.5% $MgCO_3$; 90% thru 10 mesh; 25% thru 100 mesh; 50% thru 50 mesh	1.50
Brandon and Middlebury, Vt.—Pulverized, bags, 5.50; bulk	7.00

(Continued on next page.)

Agricultural Limestone

Bridgeport and Chico, Texas—Analysis, 94% $CaCO_3$, 2% $MgCO_3$; 100% thru 10 mesh 1.75
50% thru 4 mesh 1.50
Chicago, Ill.—50% thru 100 mesh; 90% thru 4 mesh ..... .80
Columbia, Krause. Valmeyer, Ill.—Analysis, 90% $CaCO_3$; 100% thru 4 mesh ..... 1.10@ 1.50
Cypress, Ill.—90% thru 50 mesh, 50% thru 100 mesh, 90% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh 1.35
Danbury, Conn.—Analysis, 79% $CaCO_3$, 11% $MgCO_3$; 60% thru 100 mesh; 80% thru 50 mesh; 100% thru 4 mesh; bags, 4.25; bulk 3.25
Dundas, Ont.—Analysis, 54% $CaCO_3$; $MgCO_3$, 43%; 50% thru 50 mesh 1.00
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh 1.50
Kansas City, Mo.—50% thru 100 mesh ..... .75
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% through 10 mesh; 46% through 60 mesh 2.00
Screenings (¼ in. to dust) 1.00
Marblehead, Ohio.—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$, 32% thru 100 mesh; 51% thru 50 mesh; 83% thru 10 mesh; 100% thru 4 mesh (meal) bulk 1.60
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 50% thru 50 mesh ..... 1.85@ 2.35
McCook, Ill.—90% thru 4 mesh ..... .90
Middlepoint, Bellevue, Kenton, Ohio; Monroe, Mich.; Huntington and Bluffton, Ind.—Analysis, 42% $CaCO_3$, 54% $MgCO_3$; meal, 100% thru 4 mesh; 20% thru 100 mesh 1.50
Moline, Ill., and Bettendorf, Iowa—Analysis, 97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh 1.50
Mountville, Va. — Analysis, 62.54% $CaCO_3$; $MgCO_3$, 35.94%, 100% thru 20 mesh; 50% thru 100 mesh bags 5.50
Pixley, Mo.—Analysis, 96% $CaCO_3$; 50% thru 50 mesh 1.25
50% thru 100 mesh; 90% thru 50 mesh; 50% thru 50 mesh; 90% thru 4 mesh; 50% thru 4 mesh 1.65
River Rouge, Mich.—Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk ..... .80@ 1.40
Stone City, Iowa. — Analysis, 98% $CaCO_3$; 50% thru 50 mesh ..... .75
Tulsa, Okla.—Analysis $CaCO_3$ 86.15%, 1.25% $MgCO_3$, all sizes 1.25

Pulverized Limestone for Coal Operators

Hillsville, Penn., sacks, 4.50; bulk 3.00
Joliet, Ill. — Analysis, 48% $CaCO_3$; 42% $MgCO_3$; 90% thru 200 mesh; (for mine dusting and asphalt filler) 3.50
Piqua, Ohio, sacks, 4.50@5.00 bulk ..... 3.00@ 3.50
Rocky Point, Va.—82% thru 200 mesh, 2.50@3.50 bulk, paper bags ..... 3.75@ 4.75
Waukesha, Wis.—90% thru 100 mesh, bulk 4.50

Glass Sand

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

Berkeley Springs, W. Va. ..... 2.00@ 2.25
Buffalo, N. Y. ..... 2.00@ 2.50
Cedarville and S. Vineland, N. J.—
Damp 1.75
Dry 2.25
Columbus, Ohio ..... 1.00@ 1.50
Estill Springs and Sewanee, Tenn. 1.50
Gray Summit and Klondike, Mo. ..... 1.75@ 2.00
Los Angeles, Calif.—Washed 5.00
Mapleton Depot, Penn. ..... 2.00@ 2.25
Massillon, Ohio 3.00
Mendota, Va. ..... 2.25@ 2.50
Michigan City, Ind. ..... .30@ .35
Mineral Ridge and Ohlton, Ohio 2.50
Oceanside, Calif. 3.00
Ottawa, Ill. ..... .75@ 1.00
Pittsburgh, Penn. ..... 3.00@ 4.00
Ridgway, Penn. 2.50
Rockwood, Mich. ..... 2.75@ 3.25
Round Top, Md. 2.00
San Francisco, Calif. ..... 4.00@ 5.00
Silica, Va. 2.50
St. Louis, Mo. 2.00
Sewanee, Tenn. 1.50
Thayers, Penn. 2.50
Utica, Ill. ..... .90@ 1.15
Warwick, Ohio (green) 1.75

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio		1.75
Columbus, Ohio		.30@ 1.50
Dresden, Ohio		1.25
Eau Claire, Wis.	4.25	.65@ 1.25
Estill Springs and Sewanee, Tenn.	1.35@ 1.50	1.35@ 1.50

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Ambridge & So. H'g'ts, Penn.	1.25	1.25	1.15	.85	.85	.85
Attica and Franklinville, N. Y.	.75	.75	.75	.75	.75	.75
Boston, Mass.‡	1.40	1.40	2.25		2.25	2.25
Erie, Pa.		1.00*		1.50*	1.75*	
Farmingdale, N. J.	.58	.48	.85	1.20	1.15	
Hartford, Conn.	.65*					
Leeds Junction, Me.		.50	1.75		1.35	1.25
Machias Jct., N. Y.	.75	.75	.85	.75	.75	.75
Montoursville, Penn.	1.00	.90	1.00	.85	.85	.80
Portland, Me.		1.00	2.25		2.00	
Shining Point, Penn.			1.00	1.00	1.00	1.00
Somerset, Penn.		2.00				
South Heights, Penn.	1.25	1.25	.85	.85	.85	.85
Washington, D. C.	.85	.85	1.70	1.50	1.30	1.30
York, Penn.	1.10	1.00				
CENTRAL:						
Algonquin and Beloit, Wis.	.50	.40	.60	.60	.60	.60
Appleton and Mankato, Minn.		.45	1.25	1.25	1.25	1.25
Attica, Ind.			All sizes .75@.85			
Barton, Wis. (f)		.50		.75	.75	.75
Chicago district, Ill.	.70	.55	.55	.60	.60	.60
Columbus, Ohio		.85	.85	.85	.85	
Des Moines, Iowa	.40	.40	1.40	1.40	1.40	1.40
Eau Claire and Chippewa Falls, Wis.	.30@ .40	.40	.80@1.25	.90	.90	
Elkhart Lake, Wis.	.40	.40	.56	.56	.50	.50
Ferrysburg, Mich.		.50@ .80	.60@1.00	.60@1.00		.50@1.25
Ft. Dodge, Iowa	.85	.85	2.05	2.05	2.05	2.05
Grand Haven, Mich.		.60@ .70		.70@ .90		.70@ .90
Grand Rapids, Mich.		.50		.80	.80	.70
Hamilton, Ohio		1.00	1.00	1.00	1.00	1.00
Hersey, Mich.		.50				.70
Humboldt, Iowa	.50	.50	1.50	1.50	1.50	1.50
Indianapolis, Ind.	.60	.60		.90	.75@1.00	.75@1.00
Joliet, Plainfield and Hammond, Ill.	.60	.50	.50	.60	.60	.60
Mason City, Ia.	.50@ .60	.50@ .60	1.30	1.30	1.20	1.20
Mankato, Minn.		.45	1.25	1.25	1.25	1.25
Mattoon, Ill.	.75@ .85	.60@ .85	.85	.85	.85	.85
Milwaukee, Wis.	.96	.91	1.06	1.06	1.06	1.06
Moline, Ill.	.60@ .85	.60@ .85	1.00@1.20	1.00@1.20	1.00@1.20	1.00@1.20
Northern New Jersey	.40@ .60	.40@ .60	1.25	1.25	1.25	1.25
Pittsburgh, Penn.	1.25	1.25	.85	.85	.85	.85
Silverwood, Ind.	.75	.75	.75	.75	.75	.75
St. Louis, Mo.	.83	1.45	1.55a	1.45	1.45	1.45
Terre Haute, Ind.	.75	.75	.75	.75	.75	
Wolcottville, Ind.	.75	.75	.75	.75	.75	.75
Waukesha, Wis.		.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	1.50	1.25	1.15	1.15
Zanesville, Ohio		.60	.50	.60	.80	
SOUTHERN:						
Charleston, W. Va. (b)			All sand, 1.40. All gravel, 1.40			
Brewster, Fla.	.60	.60	2.25			
Chattahoochie River, Fla.		.70		1.75		
Eustis, Fla.		.50@ .60				
Ft. Worth, Texas	2.00	2.00	2.00	2.00	2.00	2.00
Knoxville, Tenn.	1.25	1.25		1.20		1.20
Lindsay, Texas					.55	
Macon, Ga.		.50				
New Martinsville, W. Va.	1.00	.90@1.00		1.20@1.30		.80@ .90
Roseland, La.	.50	.50	1.25	1.50	.85	.85
WESTERN:						
Kansas City, Mo.		.70				
Los Angeles, Calif. (d)	.50	.50	1.10	1.10		1.10c
Oregon City, Ore.		1.50*	1.50*	1.50*	1.50*	1.50*
Phoenix, Ariz.	1.25*	1.25*	2.50*	2.00*	1.50*	1.25*
Pueblo, Colo.	.75	.60		1.15		1.20
San Diego, Calif.	.65@ .75	.65@ .75	1.50	1.30	1.10	1.10
Seattle, Wash. (bunkers)	1.25	1.25	1.25	1.25	1.25	1.25

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
Algonquin and Beloit, Wis.			Dust to 3 in., .40			
Chicago district, Ill.	.35					
Ferrysburg, Mich.						.65@1.00
East Hartford, Ohio	.75*					
Gainesville, Texas					.55	
Grand Rapids, Mich.				.50		
Hamilton, Ohio				.67		
Hersey, Mich.				.50		
Indianapolis, Ind.			Mixed gravel for concrete work, at .65			
Joliet, Plainfield and Hammond, Ill.	.35	1.25				
Macon, Ga.	.35@ .50				.90	
Moline, Ill. (b)	.60	.60	Concrete gravel, 50% G., 50% S., 1.00			
Ottawa, Oregon, Moronts and Yorkville, Ill.			Ave. .60 per ton all sizes			
Roseland, La.	.35					
Somerset, Penn.		1.85@2.00		1.50@1.75		
St. Louis, Mo.			Mine run gravel, 1.55 per ton			
Summit Grove, Ind.	.50	.50	.50	.50	.50	.54
Winona, Minn.	.40	.40	.60	.60	.60	.60
York, Penn.	1.10	1.00				

(a) ⅝ in. down. (b) River run. (c) 2½ in. and less.
*Cubic yd. †Include freight and bunkerage charges and truck haul. ‡Delivered on job by truck.
(d) Less 10c per ton if paid E.O.M. 10 days. (e) pit run. (f) plus 15c winter loading charge.
(g) ¾-in. and less.

Core and Foundry Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

City or shipping point	Molding, fine	Molding, coarse	Molding, brass	Core	Furnace lining	Sand blast	Stone sawing
Aetna, Ill.				.30@ .35			
Albany, N. Y.	2.75	2.75	2.75	1.75@2.75	1.75	1.75@4.00	
Arenzville, Ill.	1.50@1.75			1.00			
Beach City, Ohio	1.75@2.00	1.75@2.00		1.75	2.00		1.75
Buffalo, N. Y.	1.50	1.50		2.00@2.50			
Columbus, Ohio	1.25@2.00	1.25@1.75	2.00@2.50	.30@1.50	2.00@2.50	2.75@3.50	1.50@3.00
Dresden, Ohio	1.50@1.75	1.50	1.75	1.25			
Eau Claire & Chippewa Falls, Wis.						3.00@4.00	
Elco, Ill.	Ground silica per ton in carloads—18.00@31.00						
Estill Springs and Sewanee, Tenn.	1.25			1.25		1.35@1.50	
Franklin, Pa.	2.00	2.00	2.25	2.00			
Klondike, Mo.	1.75@2.00		1.75@2.00	1.75@2.00	1.75@2.00		1.75
Maplet'n Depot, Pa.	2.00@2.25	2.00		1.90@2.00		2.00	
Massillon, Ohio	2.50	2.50		2.50	2.50		
Mendota, Va.	Ground flint or silex—16.00@20.00 per ton						
Michigan City, Ind.				.30@ .35	.30@ .35		
Millville, N. J.				1.75b		3.50	
New Lexington, O.	2.75	2.25					
Ohlton, Ohio	1.75b	1.75b		2.00b	1.75b	1.75b	
Ottawa, Ill.	2.50	1.25	2.50	1.00	.75	3.50	3.50
Ridgeway, Pa.	1.50	1.50	1.75@2.00c	2.50d			
Round Top, Md.	1.25			1.60		2.25	
San Francisco and Oakland, Calif.	3.50	5.00	3.50	3.50@5.00e	3.50@5.00	3.50@5.00	
Silica, Va.	Potters' flint per ton, 9.00@10.00						
Thavers, Penn.	1.25	1.25		2.00			
Utica, Ill.¶	.50@ .75	.50@ .75		.50@ .75	.75		
Utica, Ill.	.55.	.60		.75	.75		
Utica, Penn.	1.75	1.75		2.00			
Warwick, Ohio	*1.75@2.25	*1.75@2.25	*1.75	*1.75@2.25	*1.75@2.25		
Zanesville, Ohio	2.00‡	1.50‡	2.00‡	2.00	2.00		

*Green. †Crude silica, crushed and screened, not washed or dried. ‡Plus 75c per ton for winter loading. ¶Crude. §Crude and dry. (a) Delivered. (b) Damp. (c) Shipped from Albany. (d) Delivered Buffalo or Black Rock. (e) Washed and drained only, 1.50.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y., Emporium, Erie and Dubois, Pa.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
Eastern Penn.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Northern N. J.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Reading, Penn.	2.50	1.00		1.25			
Western Penn.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	2.05*	1.30*	1.80*	1.45*		1.45*	
Jackson, Ohio		1.05*		1.30*	1.05*	1.30*	
Toledo, Ohio	1.50	1.25	1.25	1.25	1.25	1.25	1.25
Youngst'n, O., dist.	2.00	1.25	1.35	1.35	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.		1.45*		1.55*	1.55*	1.55*	1.55*
Ensley and Alabama City, Ala.	2.05	.80	1.35	1.25	.90	.90	.80
Longdale, Roanoke, Ruessens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15
Woodward, Ala.	2.05*	.80*	1.35*	1.25*	.90*	.90*	

*5c per ton discount on terms.

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Berkeley, R. I.			12.00					2.15e
Buffalo, N. Y.		12.00	12.00	12.00			10.00	1.95d
Chazy, N. Y.		8.50	7.50	10.00		15.50$_9$	8.50	14.00
Lime Ridge, Penn.							5.00a	
West Stockbridge, Mass.	12.00	10.00	5.60					2.00t
Williamsport, Penn.			10.00				6.00	
York, Penn.		9.50	9.50	10.50	8.50	10.50	8.50	1.65i
CENTRAL:								
Afton, Mich.							8.50	1.35
Carey, Ohio	12.50	8.50	8.00		9.00		8.00	2.00
Cold Springs, Ohio		8.50	8.50				8.00	
Delaware, Ohio	15.00	8.50	8.50	10.00			7.50	1.50$_6$
Frederick, Md.		10.00	10.00	10.00	8.50	10.00	7.00	
Gibsonburg, Ohio	12.50	8.50	8.50		9.00	11.00	8.00	
Huntington, Ind.	12.50	8.50	8.50		9.00		8.00	
Luckey, Ohio	12.50							
Marblehead, Ohio		8.50	8.50		9.00		8.00	1.50w
Milltown, Ind.		9.00@10.00		10.00p			8.50q	1.40r
Sheboygan, Wis.	11.50						9.50	.95
Wisconsin points (f)		11.50					9.50	
Woodville, Ohio	12.50	8.50	8.50	13.50	9.00	11.00$_1$	9.00	1.50c
SOUTHERN:								
Allgood, Ala.	12.50	10.00			8.50		8.50	1.50
El Paso, Texas							7.00	1.50
Graystone, Ala.	12.50	10.00					8.50	1.50
Keystone, Ala.	10.00	8.00	8.00	8.00			7.00	1.25
Knoxville, Tenn.	20.25	8.00	8.00	8.00	7.00		7.00	1.25
New Braunfels, Tex.	18.00	12.00	10.00	12.00	10.00		9.50	
Ocala, Fla.	12.00	11.00	10.00				12.00	1.50
Saginaw, Ala.	12.50	10.00	9.00	10.00			8.50	1.50
WESTERN:								
Kirtland, N. M.							15.00	
Limestone, Wash.	15.00	15.00	10.00	15.00	16.50	16.50	16.50	2.09
Los Angeles, Calif.	19.00	19.00	14.00		16.20		12.50	2.50
Dittlinger, Tex.		12.00@13.00					9.50p	1.50$_4$
San Francisco, Calif.	21.00	19.00	16.50				14.00	2.00
Tehachapi, Calif.			8.00				13.00z	2.20x
Seattle, Wash.	19.00	19.00	12.00	19.00	19.00		18.60	2.30

†50-lb. paper bags; (a) net ton; (c) wooden, steel 1.70; (d) steel; (e) per 180-lb. barrel; (f) dealers' prices, net 30 days less 25c disc. per ton on hydrated lime and 5c per bbl. on lump if paid in 10 days; (i) 180-lb. net barrel, 1.65; 280-lb. net barrel, 2.65; (p) to 11.00; (q) to 8.75; (r) to 1.50; (s) in 80-lb. burlap sacks; (t) to 3.00; (u) two 90-lb. bags; (v) oil burnt; wood burnt 2.25@2.50; (x) wood, steel 2.30; (z) to 15.00; (*) quoted f.o.b. New York; (‡) paper bags; (w) to 1.50 in two 90-lb. bags, wood bbl. 1.60; (y) to 10.00; ($_1$) 80-lb. paper bags; ($_2$) to 3.00; ($_3$) to 9.00; ($_4$) to 1.60. ($_5$) to 16.00; ($_6$) wood bbl., steel, 1.80; ($_7$) quoted f.o.b. Marble Cliff, Ohio; ($_8$) superfine; ($_9$) barrels.

Miscellaneous Sands

(Continued)

City or shipping point	Roofing sand	Traction
Mapleton Depot, Penn.		2.00@ 2.25
Massillon, Ohio		2.25
Michigan City, Ind. (Engine sand)		.20@ .30
Mineral Ridge, Ohio	*1.75	*1.75
Montoursville, Penn.		1.00@ 1.10
Ohlton, Ohio	1.80	1.80
Ottawa, Ill.	1.25@ 2.50	1.25
Red Wing, Minn.		1.25
Round Top, Md.	2.25	1.75
San Francisco, Calif.	3.50	3.50
Thayers, Penn.		2.25
Utica, Ill.	†.90	.90
Warwick, Ohio		2.25
Zanesville, Ohio		2.50

*Wet. †Fine; coarse dry, 3.00@3.50.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Baltimore, Md.:	
Crude talc (mine run)	3.00@ 4.00
Ground talc (20-50 mesh), bags	10.00
Cubes	55.00
Blanks (per lb.)	.08
Pencils and steel worker's crayons, per gross	.08 1.00@ 1.50
Chatsworth, Ga.:	
Crude talc	4.00@ 5.00
Ground talc (20-50 mesh)	6.00@ 8.00
Ground talc (150-200 mesh)	6.00@12.00
Pencils and steel worker's crayons, per gross	1.00@ 2.00
Misc. (cubes, blanks, chalk, etc.), per lb.	.10@ .20
Chester, Vt.:	
Crude talc	3.50@ 4.00
Ground talc (150-200 mesh), bulk	8.00@ 9.00
Including bags	9.00@10.00
Chicago and Joliet, Ill.:	
Ground (150-200 mesh), bags	30.00
Dalton, Ga.:	
Crude talc	5.00
Ground talc (150-200) bags	10.00@12.00
Pencils and steel workers' crayons, per gross	1.00@ 1.50
Emeryville, N. Y.:	
(Double air floated) including bags;	
325 mesh	14.75
200 mesh	13.75
Hailesboro, N. Y.:	
Ground white talc (double and triple air floated) including bags, 300-350 mesh	15.50@20.00
Henry, Va.:	
Crude (mine run)	3.50@ 4.00
Ground talc (150-200 mesh), bulk	8.50@16.00
Joliet, Ill.:	
Roofing talc, bags	12.00
Ground talc (200 mesh), bags	30.00
Keeler, Calif.:	
Ground (200-300 mesh), bags	20.00@30.00
Natural Bridge, N. Y.:	
Ground talc (125-200 mesh), bags	10.00@15.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn.—B.P.L. 68-72%	3,75@ 4.25
Mt. Pleasant, Tenn.—B.P.L. 75%	5.50@ 6.00
Tennessee—F.O.B. mines, gross ton, unground brown rock, B.P.L. 72%	5.00
B.P.L. 75%	6.00
Twomey, Tenn.—B.P.L. 65%, 2000 lb.	8.00@ 9.00

Ground Rock

(2000 lbs.)

Centerville, Tenn.—B.P.L. 65%	8.00
Gordonsburg, Tenn.—B.P.L. 65-70%	4.00@ 4.50
Mt. Pleasant, Tenn.—B.P.L. 70%	9.00
Twomey, Tenn.—B.P.L. 65%	8.00@ 9.00

Florida Phosphate

(Raw Land Pebble)

(Per Ton.)

Florida—F. O. B. mines, gross ton, 68/66% B.P.L., Basis 68%	3.25
70% min. B.P.L., Basis 70%	3.75

Mica

Prices given are net, F.O.B. plant or nearest shipping point.

Pringle, S. D.—Mine run, per ton	125.00
Punch mica, per lb.	.06
Scrap, per ton, carloads	20.00
Rumney Depot, N. H.—per ton,	
Mine run	360.00
Clean shop scrap	25.00
Mine scrap	22.00
20 mesh	30.00
60 mesh	45.00
100 mesh	50.00
Roofing mica	35.00
Punch mica, per lb.	.12

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Barton, Wis., f.o.b. cars		10.50
Brandon, Vt.—English pink, English cream and coral pink	*11.00	*11.00
Brandon grey	*11.00	*11.00
Brighton, Tenn.—Pink	6.00	5.00
Mixed pink and bronze	4.50@ 6.00	4.50@ 6.00
All colors, mixed sizes	3.50	3.50
Buckingham, Que.—Buff stucco dash		12.00@14.00
Chicago, Ill. — Stucco chips, in sacks f.o.b. quarries		17.50
Crown Point, N. Y.—Mica spar		9.00@10.00
Dayton, Ohio		6.00@24.00
Easton, Penn., and Phillipsburg, N. J.		12.00@16.00
Haddam, Conn. — Felstone buff	15.00	15.00
Harrisonburg, Va.—Bulk marble (crushed, in bags)	†12.50	†12.50
Ingomar, Ohio — Concrete facings and stucco dash		4.25
Middlebrook, Mo.—Red		20.00@25.00
Middlebury, Vt.—Middlebury white	‡9.00	‡9.00
Middlebury and Brandon, Vt.—Caststone, per ton, including bags		5.50
Milwaukee, Wis.		14.00@34.00
Newark, N. J.—Roofing granules		7.50
New York, N. Y.—Red and yellow Verona		32.00
Red Granite, Wis.		7.50
Stockton, Calif. — "Natrock" roofing grits		12.00@15.00
Tuckahoe, N. Y.—Tuckahoe white	12.00	
Wauwatosa, Wis.		20.00@32.00
Wellsville, Colo.—Colorado Travertine Stone	15.00	15.00

†C.L. L.C.L. 17.00.
*C.L. including bags; L.C.L. 14.50
‡C.L. including bags, L.C.L. 10.00.

Potash Feldspar

Auburn and Brunswick, Me.—Color, white; 98% thru 140 mesh bulk 19.00

Buckingham, Que.—Color, white; analysis, K_2O, 12-13%; Na_2O, 1.75%; bulk 9.00

De Kalb Jct., N. Y.—Color, white; bulk (crude) 9.00

East Hartford, Conn.—Color, white, 95% through 60 mesh, bags 16.00
96% thru 150 mesh, bags 28.00

East Liverpool, Ohio—Color, white; 98% thru 200 mesh, bulk 19.35
Soda feldspar, crude, bulk, per ton 22.00

Erwin, Tenn.—Color, white; analysis, 12.07% K_2O, 19.34% Al_2O_3; Na_2O, 2.92%; SiO_2, 64.76%; Fe_2O_3, .36%; 98.50% thru 200 mesh, bags, 16.90; bulk 15.50

Glen Tay Station, Ont., color, red or pink; analysis: K_2O, 12.81%, crude (bulk) 7.00

Keystone, S. D.—Prime white, bulk (crude) 8.00

Los Angeles, Calif. — Color, white; analysis, K_2O, 12.16; Na_2O, 1.53; SiO_2, 65.60; Fe_2O_3, .10; Al_2O_3, 19.20; crude 11.00
Pulverized, 95% thru 200 mesh; bags, 22.00; bulk 20.00
For glass manufacturers — (F. o. b. C.L., sacks included): Grade A: Analysis, Al_2O_3, 19.20; Fe_2O_3, .10— 20.48
Grade B: Analysis, Al_2O_3, 18.94; Fe_2O_3, .10 18.33

Murphysboro, Ill.—Color, prime white; analysis, K_2O, 12.60%; Na_2O, 2.35%; SiO_2, 63%; Fe_2O_3, .06%; Al_2O_3, 18.20%; 98% thru 200 mesh; bags, 21.00; bulk 20.00

Penland, N. C.—Color, white; crude, bulk 8.00
Ground, bulk 16.50

Spruce Point, N. C., and Bristol, Tenn.—Color, white; 90% thru 200 mesh, bulk 12.50@20.00

Tenn. Mills—Color, white; analysis K_2O, 18%; Na_2O_3, 10%; 68% SiO_2: 99% thru 200 mesh; bulk 18.00
99% thru 140 mesh, bulk 16.00

Topsham, Me.—98% thru 140 mesh, bulk 19.00

Toronto, Can.—Color, flesh; analysis K_2O, 12.75%; Na_2O, 1.96%; crude 7.50@ 8.00

Chicken Grits

Afton Mich. (limestone) per ton	10.00
Belfast and Rockland, Me.—(Limestone), bags, per ton	‡10.00
Brandon and Middlebury, Vt., per ton	10.00
Cartersville, Ga.—(Limestone), per bag	2.00
Centerville, Iowa (gypsum) per ton	18.00
Chico, Texas (limestone), 100 lb. bags, per ton	8.00@ 9.00
Danbury, Conn. (limestone), bulk	6.00@ 7.00
Easton, Penn.—Per ton, bulk	3.00
Joliet, Ill.—(Limestone), bags, per ton	4.50
Knoxville, Tenn.—per bag	1.25
Los Angeles, Calif. (feldspar) per ton	15.00
Gypsum, Ohio.—(Gypsum) per ton	10.00
Limestone, Wash. (limestone) per ton	12.50
Rocky Point, Va. (limestone) 100 lb. bags, 50c; sacks, per ton, 6.00 bulk	5.00
Seattle, Wash.—(Limestone), bulk, per ton	12.00
Warren, N. H.—(Mica) per ton	3.85@ 3.90
Waukesha, Wis.—(Limestone), per ton	8.00
West Stockbridge, Mass.—(Limestone) bulk	‡7.50@*9.00
Wisconsin Points (limestone) per ton	9.00

*L.C.L. †Less than 5-ton lots. ‡C.L.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Albany, Ga.	10.00@11.00
Anaheim, Calif.	10.50@11.00
Barton, Wis.	10.50@13.00b
Boston, Mass.	*17.00
Brighton, N. Y.	*19.75
Brownstone, Penn.	11.50@12.00
Dayton, Ohio	12.00@13.50
Detroit, Mich.	17.50
Farmington, Conn	13.00
Grand Rapids, Mich.	12.00
Hartford, Conn.	*19.00
Jackson, Mich.	12.25
Lakeland, Fla.	10.00@11.00
Lake Helen, Fla.	8.00@15.00
Lancaster, N. Y.	12.50
Madison, Wis.	a12.50
Michigan City, Ind.	11.00
Milwaukee, Wis.	*13.00
Minneapolis and St. Paul, Minn.	10.00
Minnesota Transfer	10.00
New Brighton, Minn.	10.00
Pontiac, Mich.	12.00@13.50
Portage, Wis.	16.00
Prairie du Chien, Wis.	18.00@22.50
Rochester, N. Y.	*19.75
Saginaw, Mich.	13.00
San Antonio, Texas	16.00
Sebewaing, Mich.	12.00
Sioux Falls, S. Dak.	13.00c
Syracuse, N. Y.	18.00@20.00*
Toronto, Canada	14.75
Wilkinson, Fla.	10.00@12.00
Winnipeg, Canada	*15.00

*Delivered on job. †Delivered in city.
‡Less 5%. ¶Dealers' price. (a) Less .50 E.O.M. 10 days. (b) Delivered to Milwaukee. (c) Delivered at yard.

Portland Cement

Prices per bag and per bbl, without bags net in carload lots.

	Per Bag	Per Bbl
Albuquerque, N. M.	.86¼	3.47
Atlanta, Ga.	.....	2.35
Baltimore, Md.	.....	2.25
Birmingham, Ala.	.....	2.30
Boston, Mass.	.....	2.13
Buffalo, N. Y.	.....	2.20
Butte, Mont.	.90¼	3.61
Cedar Rapids, Iowa	.....	2.24
Charleston, S. C.	.....	2.35
Cheyenne, Wyo.	.82¾	3.31
Cincinnati, Ohio	.....	2.32
Cleveland, Ohio	.....	2.24
Chicago, Ill.	.....	2.05
Columbus, Ohio	.....	2.29
Concrete, Wash.	.....	2.35
Dallas, Texas	.....	2.00
Davenport, Iowa	.....	2.24
Dayton, Ohio	.....	2.33
Denver, Colo.	.66¼	2.65
Detroit, Mich.	.....	1.95@2.05
Duluth, Minn.	.....	2.04
Houston, Texas	.....	2.00
Indianapolis, Ind.	.....	2.19
Jackson, Miss.	.....	2.50
Jacksonville, Fla.	.....	2.20
Jersey City, N. J.	.....	2.13
Kansas City, Mo.	.....	1.92
Los Angeles, Calif.	.62½	2.70
Louisville, Ky.	.54¼	.....
Memphis, Tenn.	.....	2.50
Milwaukee, Wis.	.....	2.10
Minneapolis, Minn.	.....	2.12
Montreal, Que.	.....	1.36
New Orleans, La.	.....	2.20
New York, N. Y.	.....	1.93
Norfolk, Va.	.....	2.17
Oklahoma City, Okla.	.....	2.46
Omaha, Neb.	.....	2.36
Peoria, Ill.	.....	2.22
Philadelphia, Penn.	.....	2.11
Phoenix, Ariz.	.81½	3.26
Pittsburgh, Penn.	.....	2.04
Portland, Colo.	.....	2.80
Portland, Ore.	.....	2.60
Reno, Nevada	.....	2.91
Richmond, Va.	.....	2.40
Salt Lake, Utah	.70¼	2.81
San Francisco, Calif.	.....	2.21
Savannah, Ga.	.....	2.50
St. Louis, Mo.	.....	2.05
St. Paul, Minn.	.....	2.12
Seattle, Wash.	.....	2.50*
Tampa, Fla.	.....	2.25
Toledo, Ohio	.....	2.20
Topeka, Kans.	.....	2.41
Tulsa, Okla.	.....	2.33
Wheeling, W. Va.	.....	2.12
Winston-Salem, N. C.	.....	2.78

NOTE—Add 40c per bbl. for bags.
†Delivered on job in any quantity, sacks extra.
‡Less 5c bbl. 10 days.
*Ten cents discount for cash, 10 days. (a) Price includes sacks.

Mill prices f.o.b. in carload lots, without bags to contractors.

	Per Bag	Per Bbl
Buffington, Ind.	.....	1.80
Chattanooga, Tenn.	.....	2.45*
Concrete, Wash.	.....	2.35
Davenport, Calif.	.....	2.05
Detroit, Mich.	.....	2.15
Hannibal, Mo.	.....	1.90
Hudson, N. Y.	.....	1.75
Leeds, Ala.	.....	1.85
Mildred, Kans.	.....	2.35
Nazareth, Penn.	.....	1.95
Northampton, Penn.	.....	1.75
Richard City, Tenn.	.....	2.05
Steelton, Minn.	.....	1.85
Toledo, Ohio	.....	2.20
Universal, Penn.	.....	1.80

*Including sacks at 10c each.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gauging Plaster	Wood Fiber	White Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	—Plaster Board— ⅜x32x 36". Wt. 1500 lb. Per M Sq. Ft.	⅜x32x 36". Wt. 1850 lb. Per M Sq. Ft.	Wallboard, ⅜x32 or 48". Lgths. 6'-10', 1850 lb. Per M Sq. Ft.
Arden, Nev. and Los Angeles, Calif.	3.00	8.00u	8.00u	10.70u	10.70u	.....	.....	.....	.....	11.70u	.....	.....	.....
Centerville, Iowa	3.00	10.00	15.00	10.00	10.00	10.50	13.50	.....	.....	13.50	.....	.....	.....
Des Moines, Ia.	3.00	8.00	9.00	10.00	10.00	10.50	13.50	12.00	24.00	22.00	18.00	21.00	30.00
Detroit, Mich.	.....	.....	.....	.....	14.30o	12.30m	.....	m9.00@11.00o	.....	.....	.....	.....	.....
Delawanna, N. J.	.....	.....	.....	.....	.....	8.00	.....	8.25@9.40	.....	.....	.14½s	.15½s	40.00@41.00
Douglas, Ariz.	.....	.....	6.00	.....	.....	.....	15.00	.....	40.00	13.50	35.00	45.00	.....
Grand Rapids, Mich.	2.75	6.00	6.00	8.00	9.00	9.00	17.50	.....	24.55	20.00	.....	.....	.....
Gypsum, Ohio	3.00	4.00	6.00	8.00	9.00	9.00	20.00	7.00	27.00	19.00	.....	15.00	30.00
Los Angeles, Calif.	.....	.....	7.50@9.50	11.50y	.....	.....	.....	.....	.....	.....	.....	.....	.....
Port Clinton, Ohio	3.00	4.00	6.00	10.00	9.00	9.00	21.00	7.00	30.15	20.00	.....	20.00	30.00
Portland, Colo.	.....	.....	.....	10.00	.....	.....	.....	.....	.....	.....	.....	.....	.....
San Francisco, Calif.	.....	.....	11.65m	13.40r	14.40r	.....	15.40r	.....	.....	.....	.....	.....	.....
Seattle, Wash.	6.40	11.00	11.00	13.00	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sigurd, Utah	.....	.....	.....	.....	.....	.....	.....	.....	21.50	.....	.....	.....	.....
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00	.....	.....	.....	.....	20.00	25.00	33.00

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable).
*To 3.00; †to 11.00; ‖to 12.00; ‡prices per net ton, sacks extra; (a) to 25.00: (b) net; (c) gross; (d) hair fibre; (e) delivered; (h) delivered in six states; (f) delivered on job; (k) sacks 12c extra, rebated; (m) includes paper bags; (o) includes jute sacks; (r) including sacks at 15c; (s) per board; (t) to 16.50; (u) includes sacks; (v) F.O.B. N. Y. C. and dealer's yard in mill locality; (x) Hardwall plaster; (y) sacks 15c extra, rebated.

Market Prices of Cement Products

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point

City of shipping point	Sizes 8x8x16	8x10x16	8x12x16
Camden, N. J.	17.00	.....	.....
Cement City, Mich.		5x8x12—55.00¶	
Columbus, Ohio	.16@.18a	.....	.....
Detroit, Mich.	.16	.....	.18
Forest Park, Ill.	18.00*	23.00*	30.00*
Grand Rapids, Mich.	15.00	.....	.....
Graettinger, Iowa	.18@.20	.....	.....
Indianapolis, Ind.	.13@.15†	.....	.....
Los Angeles, Calif.¶	5¾x3½x12—55.00	7¾x3½x12—65.00	
Oak Park, Ill.	18.00	.....	.....
Olivia and Mankato, Minn.	9.50b	.....	.....
Somerset, Penn.	.20@.25	.....	.....
Tiskilwa, Ill.	.16@.18†	.....	.....
Yakima, Wash.	20.00*	.....	.....

*Price per 100 at plant. †Rock or panel face. (a) Face. ‡Delivered. ¶Price per 1000. (b) Per ton.

Cement Roofing Tile

Prices are net per sq. in carload lots, f.o.b. nearest shipping point unless otherwise stated.

Camden and Trenton, N. J.—8x12, per sq.

Red	15.00
Green	18.00
Chicago, Ill.—per sq.	20.00

Cicero, Ill.—Hawthorne roofing tile, per sq.

	Chocolate, Red and Orange	Green Blue
French and Spanish†	$11.50	$13.50
Ridges (each)	.25	.35
Hips	.25	.35
Hip starters	.50	.60
Hip terminals, 2-way	1.25	1.50
Hip terminals, 4-way	4.00	5.00
Mansard terminals	2.50	3.00
Gable finials	1.25	1.50
Gable starters	.25	.35
Gable finishers	.25	.35
*End bands	.25	.35
*Eave closers	.06	.08
*Ridge closers	.05	.06

*Used only with Spanish tile.
†Price per square.

Houston, Texas.—Roofing Tile, per sq.	25.00
Indianapolis, Ind.—9x15-in.	Per sq.
Gray	10.00
Red	11.00
Green	13.00
Waco, Texas:	Per sq.
4x4	.60

Cement Building Tile

Cement City, Mich	Per 1000
5x8x12	55.00
Detroit, Mich.	Per 100
5x4x12	4.50
5x8x12	8.00
Longview, Wash.	Per 1000
4x6x12	52.00
4x8x12	64.00
Mt. Pleasant, N. Y.:	Per 1000
5x8x12	78.00
Grand Rapids, Mich.:	Per 100
5x8x12	7.00
Houston, Texas:	
5x8x12 (Lightweight)	80.00
Pasadena, Calif. (Stone-Tile)	Per 100
3½x4x12	3.00
3½x6x12	4.00
3½x8x12	5.50
Tiskilwa, Ill.—8x8, per 100	15.00
Wildasin Spur, Los Angeles, Calif. (Stone-Tile)	Per 1000
3½x6x12	50.00
3½x8x12	60.00
Prairie du Chien, Wis.:	
5x8x12	82.00
5x4x12	46.00
5x8x 6 (half-tile)	41.00
5x8x10 (fractional)	82.00
Yakima, Wash.—Building tile:	
5x8x12	.10

Cement Drain Tile

Graettinger, Iowa—5 to 36 in., per ton	8.00
Olivia and Mankato, Minn.—Cement drain tile, per ton	8.00
Tacoma, Wash.—Drain tile per ft.:	
3 in.	.04
4 in.	.05
6 in.	.07½
8 in.	.10
Waukesha, Wis.—Drain tile, per ton	8.00

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	22.00	25.00@40.00
Baltimore, Md. (Del. according to quantity)	15.50	22.00@50.00
Camden and Trenton, N. J.	17.00	
Ensley, Ala. ("Slagtex")	14.50	22.50@33.50
Eugene, Ore.	25.00	35.00@75.00
Friesland, Wis.	22.00	32.00
Longview, Wash.	18.00	25.00@75.00
Milwaukee, Wis.	15.00	28.00@50.00
Mt. Pleasant, N. Y.	14.00@23.00	
Oak Park, Ill.	25.00	40.00
Omaha, Neb.	18.00	30.00@40.00
Pasadena, Calif.	10.00	
Philadelphia, Penn.	14.75	20.00
Portland, Ore.	17.50@19.50	25.00@75.00
Mantel brick—100.00@150.00		
Prairie du Chien, Wis.	14.00	22.50@25.00
Rapid City, S. D.	18.00	25.00@80.00
Waco, Texas	16.50	32.50@125.00
Watertown, N. Y.	20.00	35.00
Westmoreland Wharves, Penn.	14.75	20.00
Winnipeg, Man.	14.00	22.00
Yakima, Wash.	22.50	

†Gray. ‡Red.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted.

Culvert and Sewer	4 in.	6 in.	8 in.	10 in.	12 in.	15 in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Detroit, Mich.								15.00 per ton									
Graettinger, Iowa	.04½d	.05½	.08½	.12½	.17½	—	.40	.50	.60	.70	—	—	—	—	—	—	—
G'd Rapids, Mich. (b)																	
Culvert pipe	.....	.....	.....	.60	.72	1.00	1.28	1.60†	.....	1.92	2.32	3.00	4.00	.....	7.00	.....	—
Sewer pipe (d)	.....	.....	.....	.....	.....	.63	.....	.60†	.....	.....	.....	.58	.....	.....	.....	.....	—
Houston, Texas	.....	.19	.28	.43	.55½	.90	1.30	.....	†1.70	2.20	.....	.....	.....	.....	.....	.....	—
Indianapolis, Ind. (a)	.....	.....	.....	.80	.90	1.10	1.30	.....	.....	1.70	.....	2.70	.....	.....	.....	.....	—
Longview, Wash.							Sewer pipe 40% off list, culvert—list										
Mankato, Minn. (b)	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.50	1.75	2.50	3.25	4.25	.....	.....	—
Newark, N. J.							6 in. to 24 in., $18.00 per ton										
Norfolk, Neb. (b)	.....	.....	.....	.90	1.00	1.13	1.42	.....	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Olivia, Mankato, Minn.							12.00 per ton										
Paullina, Iowa‡	.....	.....	.....	.....	.....	.....	.....	2.25	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Somerset, Penn.	.....	.....	.....	.....	1.08	1.25	1.65	.....	.....	2.50	.....	3.65	4.85	7.50	8.50	.....	—
Tacoma, Wash.	.15	.18	.22½	.30	.40	.55	.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	—
Tiskilwa, Ill. (rein.) (a)	.....	.....	.....	.65	.75	.85	1.10	1.60	.....	1.90	.....	2.25	3.40	.....	5.50	.....	—
Wahoo, Neb. (b)	.....	.....	.....	.....	1.00	1.13	1.42	.....	.....	2.11	.....	2.75	3.58	4.62	6.14	6.96	7.78
Yakima, Wash.								$10.00 per ton									

*30-in. lengths up to 27-in. diam., 48-in. lengths after; (a) 24-in. lengths; (b) Reinforced; (c) Interlocking bar reinforced. (d) Eastern clay list, 72% off.
†21-in. diam. ‡Price per 2 ft. length. (d) 5 in. diam. [1]@1.08 [2]@1.25. [3]@1.65. [4]@2.50. [5]@3.85. [6]@5.00. [7]@7.50.

Recent Contract Prices of Rock Products

FOLLOWING are some recent bids on rock products for public works:

North Vernon, Ind.—The Jennings County Board of Commissioners met in special session recently to receive bids for crushed stone and road machinery. Only one bid was received for the crushed stone, that of Paul Frank, who was awarded the contract for 500 cu. yd. at $1.50 per yd. at crusher.

Portland, Ore.—The Star Sand and Gravel Co. submited the low bid to the commission of public docks for furnishing crushed rock and screenings with figures of $1.65 per cu. yd. for 3-in., $1.90 for 1-in. crushed rock and $1.90 for screenings.

The Columbia Contract Co. bid $1.95, $2 and $2; City Motor Trucking Co., $2, $2.15 and $2.15; Walrod Wright, Inc., $2.25, $2.25 and $2.25.

St. Paul, Minn.—Minnesota will pay an average of $2.135 per bbl., net, for cement for use in its 1927 trunk highway paving program. This was the announcement made recently by Commissioner C. M. Babcock.

The price includes the freight to the station nearest to the paving job.

Bids for the cement necessary for the 94 miles of concrete paving already under contract for the coming season were opened February 15. The successful bidders, according to the announcement, are as follows:

Universal Portland Cement Co. (Duluth plant), 116,642 bbl. at $307,435.

Northwestern States Portland Cement Co., Des Moines, 13,806 bbl. at $34,929.18.

Interstate Lumber Co., Stillwater, 24,767 bbl. at $61,669.83.

Lehigh Portland Cement Co., Des Moines, 90,685 bbl. at $220,025.02.

Cutler-Magner Co., Duluth, 41,190 bbl. at $103,919.28.

The total of these awards is $727,978.50 for 287,090 bbl., but the refund on empty sacks will be $114,836, making the net total $613,142.50.

The paving jobs under contract include 24 miles on No. 1, to complete the unfinished portions between Wyoming and Rock Creek, 20 miles on No. 2 from Morhead to Hawley, 11 miles on No. 1 from Steele Center to Ellendale, 6.6 miles on No. 3 between Newport and Hastings, 15.7 miles on No. 3 between Winona and La Crosse, 5 miles on No. 3 between Albany and Freeport, and 12.2 miles on No. 10 from Litchfield to Atwater.

Under the rule adopted two years ago,

the contractors furnish all materials except cement, which is bought separately.

Reading, Penn.—City council decided to "buy at home." It held that because the cement the J. M. Gring Co. would furnish would be made by the Allentown Portland Cement Co., at Evansville, just over the Berks county border, the Mineral Spring viaduct contract for 20,000 bbl. should be awarded this company. The city will spend about $53,460 for cement.

The Gring company bid of $2.43 a bbl. was the same as the bids of John F. Bressler Estate and of Fehr & O'Rourke, according to Councilman J. H. McConnell. The contract was awarded at a special meeting of council.

Cinder-Lime Brick Plant for Pocatello, Idaho

TAKING over the old Idaho Pressed Brick Co. yards north of Pocatello, Idaho, that have stood idle for the past eight years or more, the Intermountain Insulation Co. of Salt Lake City will begin rehabilitating the 20-acre tract, clearing it of its old machinery and kilns, putting in new, and erecting necessary buildings, ready to begin actual manufacture of brick by May 1.

The property was purchased by the Intermountain Insulation Co. from the Utah Fire Clay Co., which took it over at the time the former Idaho Pressed Brick Co. closed down.

It is the plan of the Salt Lake concern to manufacture an art brick of lime and cinders, both of which products will be procured locally. Some 25 men will be employed at the plant at the beginning of operations, it is expected. Homes for employes, it is believed, eventually will be built on the large tract surrounding the brick yard, which the purchasers, it is understood, were required to take in its entirety.

I. T. Hyde and Arthur Taylor have represented the Intermountain Insulation Co. in negotiations.—*Pocatello* (Idaho) *State Journal.*

Annual Meeting of the Iowa Concrete Products Association

APPROXIMATELY 100 producers attended a two-day annual convention of the Iowa Concrete Products Association in Hotel Montrose, at Cedar Rapids, Iowa, March 3 and 4.

Charles Manson, secretary of the Chamber of Commerce, welcomed the group to the city. H. E. Meier, president of the state association, responded to the welcome in behalf of the delegates, after which the delegates took up business matters.

In the afternoon session, W. D. M. Allen, representing the Portland Cement Association, Chicago, gave an address on more aggressive methods in marketing concrete products, which was followed by roundtable discussion, led by Austin Crabbs, Davenport; C. H. Barnes, Red Oak; Floyd Goodrich, Waterloo; H. E. Kilmer, Des Moines and Jens Larson of Walnut, Ia.

Manufacturing problems were discussed by Charles Wetzstein, Virt Anderson, V. H. Pettengill, Carl Ludwig, O. B. Lofstedt and J. Dellgardelle.

At the annual banquet and entertainment, W. R. Harris was toastmaster. Following the banquet, Irvin Kirkpatrick, Chicago, gave a demonstration in the use of stucco in color and textural effects.

A tour of inspection of the plants operated by the Builders Material Co., Concrete Products Co., and the Castone Products Co., was made on March 4.

D. R. Collins, secretary of the National Concrete Products Association, gave the delegates a talk on what it means to a member to belong to the association, and M. M. Brandon, service engineer of the Underwriters Laboratory, Chicago, stressed the service given by his organization to concrete block manufacturers.

Railways Adopt Water-Cement Ratio Law

THE American Railway Engineering Association officially adopted a specification for proportioning concrete based on the water-cement ratio law of strength at its annual convention at the Palmer House, Chicago, March 10. This specification was prepared for adoption by the association's masonry committee of which C. C. Westfall, bridge engineer of the Illinois Central Railroad, is chairman, and Job Tuthill, assistant chief engineer of the Pere Marquette Railway, is vice-chairman.

The adoption of this specification by the American Railway Engineering Association marks the abandonment of the 1:2:4 and other arbitrary mixes that have been in use for many years. Instead, the ratio of water to cement is specified, and the proportions of sand and stone are largely left to the discretion of the individual engineer. According to this law, the strength of concrete, within the limits of plastic, workable mixes, is inversely proportional to the amount of water used.

This specification, by its adoption on March 10, will become recommended standard practice for all railroads in the United States and Canada and will appear in the Association's "Manual of Recommended Practice."

A new specification for portland cement was also accepted. This specification was recently adopted by the American Society for Testing Materials and was prepared by Committee C-1 of that Society. C. C. Westfall, J. J. Yates and M. Hirschthal, members of this committee, also belong to the masonry committee of the American Railway Engineering Association.

Cement Pipe Company Expands

THE Faulkner Concrete Pipe Co., which now has a concrete pipe plant at Hattiesburg, Miss., proposes to enlarge its operation by locating a $50,000 plant at Jackson, Miss., and a similar plant at Mobile, Ala.

L. E. Faulkner is president of the company and George B. Denham, now office engineer in the State Highway Engineer's office at Jackson, Miss., will be vice-president and general manager of the company, effective April 1.

These plants will manufacture both plain and reinforced-concrete pipe, in sizes ranging from 6-in. to 36-in., and for use in sanitary sewers, storm-water sewers and under highway and railway embankments.

The daily capacity of each plant will be 40 tons of pipe.

The new plants at Jackson, Miss., and Mobile, Ala., will be in buildings 60 ft. by 200 ft., constructed of galvanized iron and with concrete floors. A No. 1 and No. 3 Bullen pipe machine will be installed at Mobile and a No. 2 Bullen pipe machine will be installed at Jackson. These machines have been ordered from the Tuerk-MacKenzie Co., Portland, Ore.

The sites for both locations have been purchased and construction on the two plants will start within the next few weeks. The site at Mobile is on the property of the Alabama Dock Board, the pipe company being the first industry to locate on this property.

Two New Cement Products Plants in Massachusetts

ALBERT P. NELSON, formerly chief engineer at the Cities Service Refining Co., East Braintree, Mass., is now establishing a corporation to be known as the Nelson Cement Stone Co., Inc., with headquarters in Braintree.

Mr. Nelson established for himself an enviable reputation as a construction engineer during the construction of the refinery at East Braintree when it was being .built When the Cities Service Co., took over the refinery Mr. Nelson was retained as chief engineer.

A new industry is soon to locate at Concord Junction, Mass., according to George G. Russell, a local real estate man, who has been responsible for adding this new business to the community.

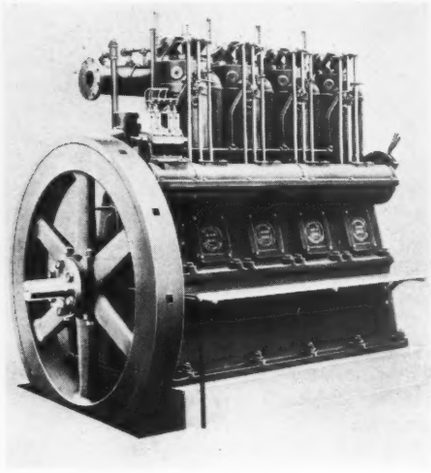
The Atlantic Cement Products Corp. will, it is understood, locate near the corner of Conant and Main street, erecting a concrete structure for the manufacture and storage of its product. The office of the company is at the Park Square building in Boston, and the company's plant, now at Newton Lower Falls, will be moved to Concord Junction.

The officers of the company are Raymond G. Eggleton, president, and F. E. Freeman, treasurer. Mr. Eggleton has lived at Concord Junction for some time.

New Machinery and Equipment

New Diesel Engine

THE Chicago Pneumatic Tool Co., New York, N. Y., is now marketing a new line of M W M (Motoren Wereken Manheim) Benz solid injection type Diesel engines from 80 to 240 hp. at 327 r.p.m., for which the company has secured the American manufacturing rights. It is interesting



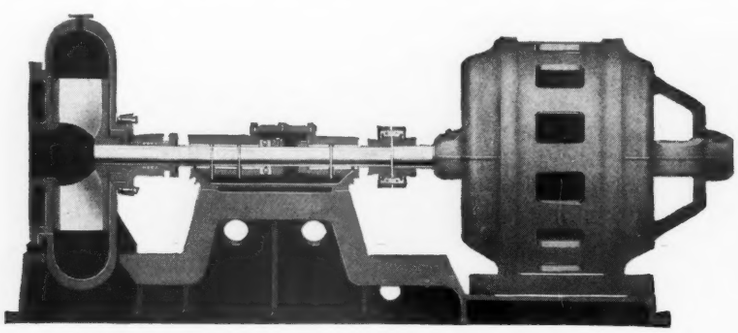
New Diesel engine

to note that the *Deutschland*, the German submarine whose exploits rather startled the world, was equipped with a Diesel engine of this make. Since the war, the manufacturers say, the design of the Benz Diesel has been further developed and improved so as to adapt it to industrial purposes, and many new constructional and operating features added.

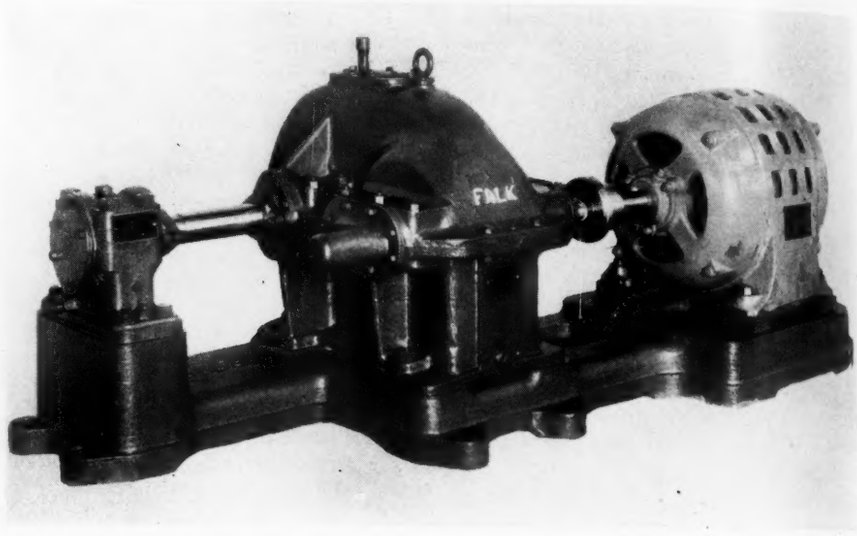
New Centrifugal Dredging Pumps

HETHERINGTON & BERNER, Indianapolis, Ind., have recently developed a new centrifugal dredging pump for sand and gravel operations. The pump is made in four sizes, 4-, 6-, 8- and 10-in. The 4-in. is particularly designed for pumping sand, water and fine gravel, and can, it is said, handle gravel with pebbles up to 2 in. in diameter. The 6-in. pump is for ordinary gravel pumping, handling stones up to 4-in. diameter. The 8-in. pump is for the commercial gravel plant and can, it is said, handle stone up to 6-in. diameter. Under identical conditions and in the hands of the same operator, it is claimed, the 8-in. pump will get out double the daily output of the 6-in. pump. All three sizes are of strong construction and built for operation at high speeds. The pump shell is a heavy, one-piece casting of semi-steel, reinforced by six ribs and anchored to a base. Either top or bottom discharge can be furnished as desired. Removable side plate is also of semi-steel. The impeller is a one-piece, semi-steel casting, of the enclosed type. Its driving surfaces are faced with replaceable steel shoes.

The shell is fitted with stuffing box at hub and water seal ring, maintained under pressure to prevent leakage of air or water. All shaft bearings are extra long, with heavily babbitted surfaces. End thrust bearings are of the ball type. Driving shaft is high-carbon steel fitted to the impeller by press fit and key. The base is a heavy iron casting to which shell and bearing standards are securely bolted. Front bearing standard is anchored to shell with adjustable steel rods to keep the shaft in alignment. The pumps are regularly shipped with cast iron pulleys for belt drive, but for additional charge special shaft and base are furnished by the manufacturers for attaching electric motor.



Centrifugal dredging pump direct connected to electric motor



Continuous tooth herringbone type speed reducer

New Line of Speed Reducers

THE Falk Corp., Milwaukee, Wis., has brought out a new line of speed reducers featuring the Falk continuous tooth, all steel herringbone gears.

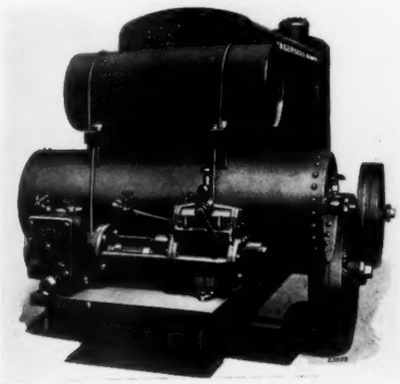
Through use of a special design of housing said to eliminate any internal ribs, projections or complicated cores the lubrication of the machine has been simplified and all possibility of dirt or core sand working into the gears is said to be removed. Added features claimed are the airplane type steel-backed, babbitt-lined bearings said to be capable of carrying heavier loads and an improved automatic continuous lubrication system.

This line covers a certain number of standard reduction ratios. Standard motor beds have been adopted for these units. Standardization of units and beds allows stock delivery of the units.

The reducers are made in three types—single reduction for ratios up to 9:1, double reduction for ratios up to 70:1, and triple reduction for ratios up to 300:1. A double reduction unit No. 7D is shown in the illustration.

New Portable Compressor-Pump Outfit

THE Ingersoll-Rand Co., New York, has recently brought out a new combined portable air compressor and water pump outfit. It consists of a standard type 20 gasoline-engine driven portable compressor



Combination water pump and air compressor

and a Cameron air-driven pump. The unit is designed for work where either pump or air compressor or combination is desired.

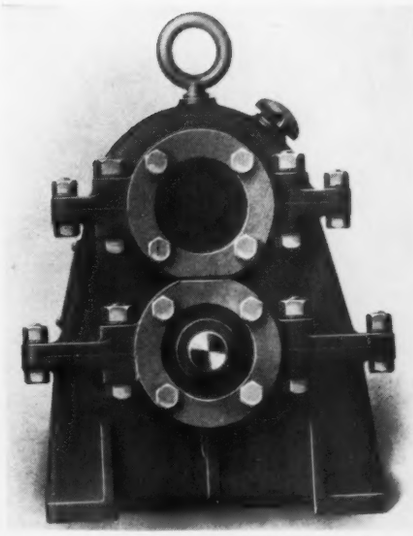
The pump is mounted on the frame of the compressor adjacent to the power source. By starting up the compressor, the pump is made ready for work. The pump capacity is adjusted by regulating the amount of air admitted. The compressor in addition to furnishing the power for the pump will run pneumatic tools such as work drills, portable hoists, drill steel sharpeners, etc.

Several sizes of these compressor-pump outfits are available. It is also possible to obtain the pump alone, together with all parts necessary for attaching it to any Ingersoll-Rand portable compressor now in use.

New Helical Gear Speed Reducer

THE R. D. Nuttall Co., Pittsburgh, Pa., have recently developed and placed on the market a complete line of speed reducers, which incorporate in their design Nuttall 7½-deg. helical gears and Timken tapered roller bearings. This series of speed reducers is known as the SVR series and covers a range of from 1 to 150 hp. The SVR series are single reduction units, with reduction ratios ranging from 1 to 1 to 8 to 1; the high and low speed shafts being parallel and offset in the same plane.

Shafts in these reducers are carbon steel forgings, with the pinions integral. They are oil treated to give them additional strength. The pinions are given a finish cut and the shafts are ground to close limits. In installations where loading requires, shafts and pinions will be made of alloy steel. The reducer case is cast from grey iron and is carefully assembled to reduce the possibility of oil leakage to a minimum. A positive system of splash lubrication, it is claimed, assures a good supply of lubricant to all the bearings and a protective oil film on the gear teeth at all times.



Helical gear speed reducer

New One-Yard Diesel Shovel

A NEW one-yard Diesel shovel, convertible to dragline, clamshell or crane, has been recently brought out by the Bucyrus Co., Milwaukee, Wis. The manufacturer's claims for the new machine are lower fuel, yardage and upkeep costs, together with increased power—a combination said to give the shovel features of swift, economical operation.

The power plant of the D-2 is a four-cycle full-Diesel engine. The fuel is fed into it mechanically, thus providing, it is said, economy of fuel consumption and avoiding the use of air compressor. In addition the engine can be started, it is claimed, stone-cold to full load in 20 seconds, no priming and preheating being necessary. The engine is mounted on a raised base which is bolted securely to the cast revolving frame—a mounting said to provide a direct connection between the main machinery and engine and to insure perfect alignment at all times.

Other features claimed by the manufacturers for the new machine are the center pintle construction, patented rope crowd and the new straight boom of lighter construction, two-part hoist and large drum in the main machinery, outside dipper handles, decreased counterweight which permits fast swings at every stage, and the caterpillar mounting which is said to have sufficient tractive power to enable the excavator to climb inclines up to 30% grade.

One-yard Diesel driven shovel

Worthington Wins Valve Infringement Suit

THE suit that has been pending in the district court of the United States at Buffalo, brought by the Worthington Pump and Machinery Corporation, for infringement of the Worthington patents. Reissue No. 13,991, granted October 12, 1915 and No. 1,341,145, granted May 25, 1920, on its "Feather" valves (used largely in air compressors) has been decided in favor of Worthington, and a decree has been entered holding both patents valid and infringed, and ordering an injunction and accounting against the infringer. Under the decision, the Worthington Pump and Machinery Corporation has the exclusive right to the use of strip valves, which bend on a uniform curve in opening, even though attached to the valve seat as in the design of valve, in this case.

How to Figure Horsepower and Torque for Spur-Gear Reducers

THE following extracts from a new catalog and data book on Jones spur-gear reducers, made by the W. A. Jones Foundry and Machine Co., Chicago, will help operating men to understand the application of speed reducers, which during the last two or three years have become so popular in all rock products plants.

General Conditions

The maximum reduction ratio considered practical in a belt drive is about 5 or 6 to 1; with a chain drive 6 or 8 to 1. These spur-gear reducers, of the single type, permit reductions up to 16 to 1, and in the double type of from 30 to 1 to 70 to 1 and up. They may be driven in either direction. The high-speed shaft, driven by the motor, and the low-speed shaft, connected to the machine to be driven, both turn in the same direction. The high-speed shaft and the low-speed shaft of this reducer are on the same center line.

Changes of Ratios and Motors

Some drives require a certain speed for present purposes with a higher or lower speed eventually to meet future conditions. In such cases it is often practical to install a gear reducer with a suitable ratio to give the proper final speed for present needs. When some other predetermined speed is necessary, a change of gears in the reducer can be made to suit the new conditions without disturbing any of the other equipment.

A variable speed motor is sometimes used, also a change of motors is occasionally necessary to obtain a different speed or power. This may be done by substituting a motor with higher or lower speed to meet future requirements. In all such cases the reducer and motor are considered with the present demands known, and future demands anticipated or predetermined insofar as possible. In this way a logical and consistent selection of machinery may be made in advance—one that lends itself readily to changing conditions in the most economical manner.

Horsepower and Torque

When figuring on speed reducer requirements, the subject involves a decrease in speed of rotation with an increase in torque, the horsepower theoretically remaining constant.

It is necessary to have a clear understanding of this subject in order to make a proper selection of machines. This is particularly essential where a large ratio of reduction is concerned as the torque increases at a rapid rate with decreasing speeds. In fact, it varies inversely with the speed of revolution, considering the power constant and neglecting friction, as illustrated below.

Unless this principle is observed, inconsistent specifications, power requirements and selection of machines will often result. A few formulas with examples are shown in the way of illustration:

NOMENCLATURE

$H.P.$ = Horsepower

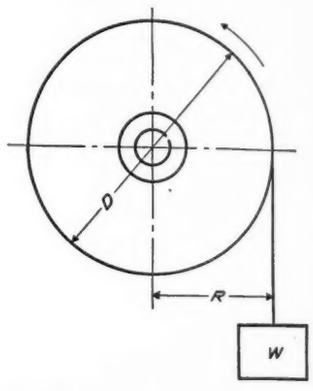


Diagram illustrating application of formulas

$T.$ = Torque in inch pounds
$N.$ = Revolutions per minute
$D.$ = Diameter in inches
$R.$ = Radius $= \frac{D}{2}$
$W.$ = Load in pounds

FORMULAS

$$H.P. = \frac{W \times 3.1416 \times D \times N}{12 \times 33000}$$

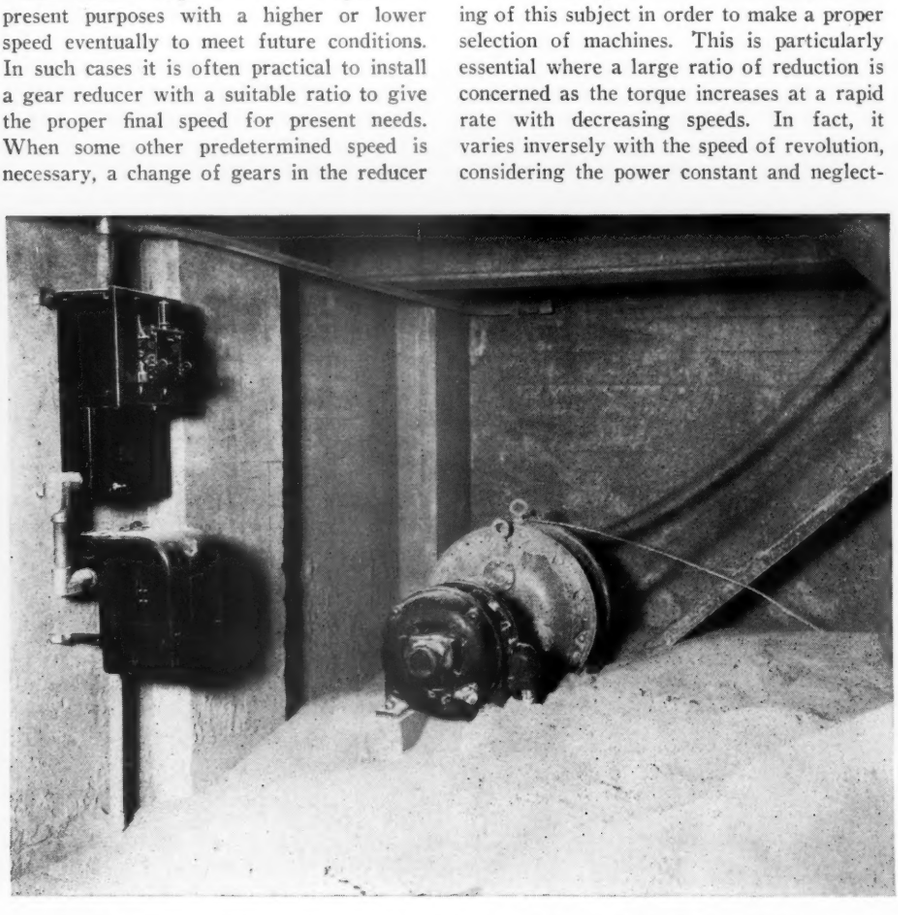
$$T. = W \times R = \frac{W \times D}{2}$$

$$H.P. = \frac{T \times N}{63025}$$

$$T. = \frac{63025 \times H.P.}{N.}$$

$$W. = \frac{2T}{D}$$

$$D. = \frac{2T}{W}$$



Electric motor and speed reducer operating under typical dusty conditions in rock products plants

Examples

(1). Find torque at high speed reducer shaft when transmitting 25 hp. at 1200 r.p.m.; also at the low speed reducer shaft when transmitting same power at 20 r.p.m. Ratio in reducer 60 to 1.

$$T=\frac{63025\times H.P.}{N}=\frac{63025\times 25}{1200}=1313.02 \text{ inch}$$

pounds torque at high speed shaft.

$$T=\frac{63025\times 25}{20}=78781.25 \text{ inch pounds torque}$$

at low speed shaft.

(2). Find torque at low speed shaft of a spur gear speed reducer when coupled to a car puller shaft. Pitch diameter of drum on car puller 36-in., load on cable winding around drum 5,000 lb.

$$T=W\times R=\frac{W\times D}{2}=\frac{5000\times 36}{2}=90{,}000 \text{ inch}$$

pounds torque.

(3). Find horse power at above car puller shaft when driven at 10 r.p.m.

$$H.P.=\frac{T\times N}{63025}=\frac{90000\times 10}{63025}=14.28 \text{ horse}$$

power.

(4). What would the torque be at the above shaft if only 2 hp. were delivered at 1 r.p.m.?

$$T=\frac{63025\times H.P.}{N}=\frac{63025\times 2}{1}=126{,}050 \text{ inch}$$

pounds torque.

(5). What load would the above torque produce on a cable winding around drum having a pitch diameter of 12-in.?

$$W=\frac{T}{R}=\frac{2T}{D}=\frac{2\times 126050}{12}=21008.33 \text{ pounds.}$$

(6). Establish pitch diameter of drum to produce a load of 5,000 lbs. on a cable with torque of 126,050 inch pounds at the drum shaft.

$$D=\frac{2T}{W}=\frac{2\times 126050}{5000}=50.42 \text{ inches pitch}$$

diameter.

The above simple formulas and examples form a general basis for calculations of a like nature and may be of assistance when estimating and specifying power requirements.

Particularly where a large ratio is involved and the speed is reduced down to only a few revolutions per minute, or in some cases to only a fraction of a revolution per minute, it is important to determine the actual torque at this final speed and from that the horse power at this point necessary to cause rotation.

The horse power at the motor must, of course, be sufficient to compensate for inevitable frictional losses and to provide for starting duty depending on the nature of service and character of the operating conditions.

Rating and Selecting Machines

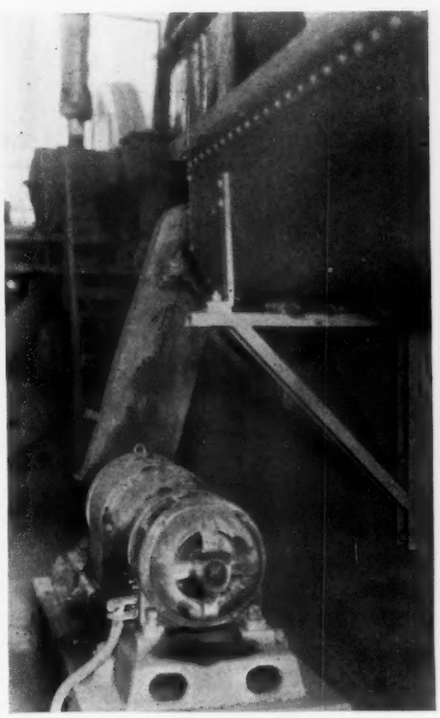
Machines as customarily rated in tables are intended for 8 to 10 hours service per day under ordinary conditions of uniform load. When the service is 8 to 10 hours per day with occasionel shocks or peak loads, or when the service is 24 hours per day with moderate smooth load, the manufacturers suggest taking 75% of the rated capacities given in the tables.

When the nature of the load is quite severe with pulsations, heavy shocks or reversals, about 60% of the rated capacities given should be used. On drives required to operate continuously 24 hours per day with severe pulsations or shocks, the ratings should not be decided without conference with the gear manufacturer.

For light duty or intermittent service, without the possibility of shocks or overloads during operation, reducers may at times be installed for use at 25% above their normal rated capacity.

The proper selection of gears and the rated capacity given them, requires engineering ability, coupled with judgment and experience, to give the best results. The rated capacity should also vary with the nature of service, character of the operating conditions, and general class of duty to be performed.

Even the most approved method of determining capacities of gears is not an exact science. It is not considered good practice to design a gear and give it a definite power rating in the absence of all information as to how and where it will be used. A calculation of the strength of gear teeth alone is not sufficient for determining proper, or permissible loads, as other factors outside of strength must be taken into account; wearing qualities, the number of teeth in contact, the ability to maintain a film of oil between the surfaces, and many other conditions all have a bearing on the allowable capacity.



Screw conveyor from grinding mill in a cement plant. The drive is by a 10-hp. electric motor, 865 r.p.m., through a 16:1 speed reducer

Science and Engineering of Lime Burning Discussion at Chemical Society Meeting

THE application of science and engineering in the lime industry, with a resulting improvement in products and increased efficiencies in production, will be one of the feature discussions of the lime symposium which will be held by the industrial division at the Richmond meeting of the American Chemical Society, April 12-16.

Proper kiln design and operation for increased efficiencies will be discussed by Victor J. Azbe, consulting combustion engineer, who has designed and operated kilns at lime plants in various sections of the country and has studied the effects of different conditions of burning on the properties of widely differing stones. Tests of the effects of injection of steam in kilns will be described by E. E. Berger of the New Brunswick Station of the Bureau of Mines, and a comparison of shaft and rotary kilns will be presented by R. K. Meade, consulting engineer, of Baltimore.

Specifications for Chemical Lime

THE executive committee of the American Society for Testing Materials has, upon request from Committee C-7 on Lime, granted permission to the committee to prepare specifications for lime for the chemical industry which define a standard lime content without specifying rejection limits. Committee C-7 presented a brief urging the acceptance of this type of specification by the Society, giving among other reasons (1) that the use of lime in the chemical industry is such that the material furnished is effective insofar as it is lime; (2) that the use of a material of lower lime content is principally a matter of economic considerations; (3) that no hazard is involved in the use of a lower grade material; and (4) that such a specification, even without rejection limits, is desirable in that it sets up an equitable basis of settlement and will tend gradually to bring all production up to the standard requirement.

In approving the request the executive committee stipulated that such specifications shall be accompanied by a suitable explanatory note.

Manitoba Natural Cement Plant to Resume Operation

PLANS for the early resumption of manufacturing operations at the plant of the Commercial Cement Co., at Babcock, Man., are progressing favorably. Prior to 1924 this company manufactured a high grade of natural cement, but in that year the plant was closed down. Now, with the increase in demand for mortar cement, due to the building revival in the West, it is probable that the company will be able to operate its mills this summer.

Lincoln Sand and Gravel Company's Office Burned

THE office building of the gravel plant of the Lincoln Sand and Gravel Co., south of Lincoln, Ill., burned February 27 at an early hour. The building was located near the engine roundhouse on the north side of the lake. Employes went out to the plant in the morning and started a fire in the office stove, then leaving for the gravel screening plant, several hundred yards east of the office. There is no fire-fighting system there and the building was entirely burned. It consisted of a two-story structure with outside steps leading to the top floor where the office work was done, the lower floor being a storeroom. It was thought the fire was due to the overheated stove.—*Lincoln* (Ill.) *Courier-Herald.*

Long-Standing Marion County, Indiana, Controversy Settled

AFTER a fight of more than two years' duration, the controversy over concrete road specifications in Marion county, Indiana, of which Indianapolis is the county seat, apparently has been settled through the adoption of the specifications used by the Indiana State Highway Commission. A majority faction of the board of county commissioners has ordered Henry R. Campbell, county engineer, to use the State Highway Commission specifications. A bitter fight, which in the last county campaign was a political issue, has been waged between the gravel and stone interests since George G. Schmidt, former county engineer, took office in 1924. Mr. Schmidt prepared rigid specifications as to the coarse aggregate to be used in building concrete roads, which the gravel interests asserted were "closed" specifications.

Gravel Company Offers City Boulevard Property

THE Battjes Gravel and Sand Co. recently made the Grand Rapids, Mich., city commission a conditional gift of a 100-ft. boulevard strip along the south bank of Plaster Creek west from Madison Avenue.

The company, it was explained, owns property on both sides of the creek, extending from Madison Avenue westward a distance of approximately 1500 ft.

Under the terms of the proposal, the city is to construct a usable drive from Madison Avenue to Division Avenue before September 1, 1928; the company is to be permitted to continue to take water from the creek for its operation of washing sand and gravel and be allowed to permit the drainage to flow back into the creek until such time as the commercial sand and gravel are removed from the property between the north bank of the creek and Burton Street, and the donors of the property, their successors or assigns are not to be assessed for special improvements on the boulevard property.—*Grand Rapids* (Mich.) *Herald.*

Monmouth (N. J.) Gravel Plant Operating

THE Monmouth Washed Sand & Gravel Co., Freehold, N. J., has completed its new plant (referred to in ROCK PRODUCTS, February 19, p. 98). The new operation is now offering plastering sand, mason sand and gravel in two sizes, screened and washed. The deposit also contains an abundance of road gravel mixed with clay. The latest equipment on the market, all electrically driven, has been installed. The output to start is 500 tons per day.

The location, so far as transportation facilities are concerned, is excellent, bordering on the Pennsylvania railroad. The new concrete highway to Asbury Park, from Freehold, is within 500 ft. of the property, thus making excellent trucking facilities.

The officers of the corporation are: George Fournier, president; P. Sarabuchello, vice-president; Wood A. Arrowsmith, treasurer; Miss Louise Vanauken, secretary.

A cement-block manufacturing plant will be added in the immediate future.

Construction of Lacona Gravel Plant Well Under Way

S. D. ORMSBY, president, Lacona Sand and Gravel Co., Watertown, N. Y., adds the following details in regard to his new plant, referred to in ROCK PRODUCTS, March 5, p. 94: "The plant is located within ¼ mile of the station at Lacona, N. Y., on the main line of the New York Central Ry. from Syracuse to Watertown. Lacona is about three miles from Richland, which is a junction point. This will enable us to ship directly south to Syracuse and beyond, west to Oswego, east to Rome and Utica, and north to Watertown and Northern New York.

"The deposit is about 70 acres in extent and consists of very high grade concrete sand containing approximately 20% gravel There are also deposits of molding sand on the property.

"The plant will have a capacity of 1000 cu. yd. in 10 hours, is of Link-Belt design, Link-Belt conveyors, scrubbers, screens and sand collectors are being installed. Material will be excavated by a 1¼-yd. Lorrain 75 Thew shovel, conveyed to feeding hopper by 3-yd. Easton two-way dump cars, hauled by gasoline locomotive. From feeding hopper all material is conveyed on Goodyear belt to Link-Belt scalping screen 72-in. diameter by 12 ft. long; oversize gravel passes to 8-in. Traylor gyratory crusher. All material then passes to second belt conveyor 250 ft. long, which conveys the sand and crushed gravel to scrubbers and conical screens at top of bins which are 80 ft. above the loading track. A 6-in. direct-connected Fairbanks-Morse centrifugal, ball-bearing pump supplies water from springs which are located close by the loading bins. A second crusher (Traylor 4½-in. reduction) will be installed to recrush 1½-in. and 2½-in. gravel down to ¾-in. size A 440-volt, 25-cycle power current is supplied by the Niagara, Lockport and Ontario Power Co.

"The Lacona Sand and Gravel Co. is under the same management as the Watertown Stone Products Co., with offices together at Watertown. William J. Hinds is the plant manager at Lacona. The plant will be in operation by May 1."

Mr. Ormsby is one of several New York State quarry operators recently to go into the sand business as well.

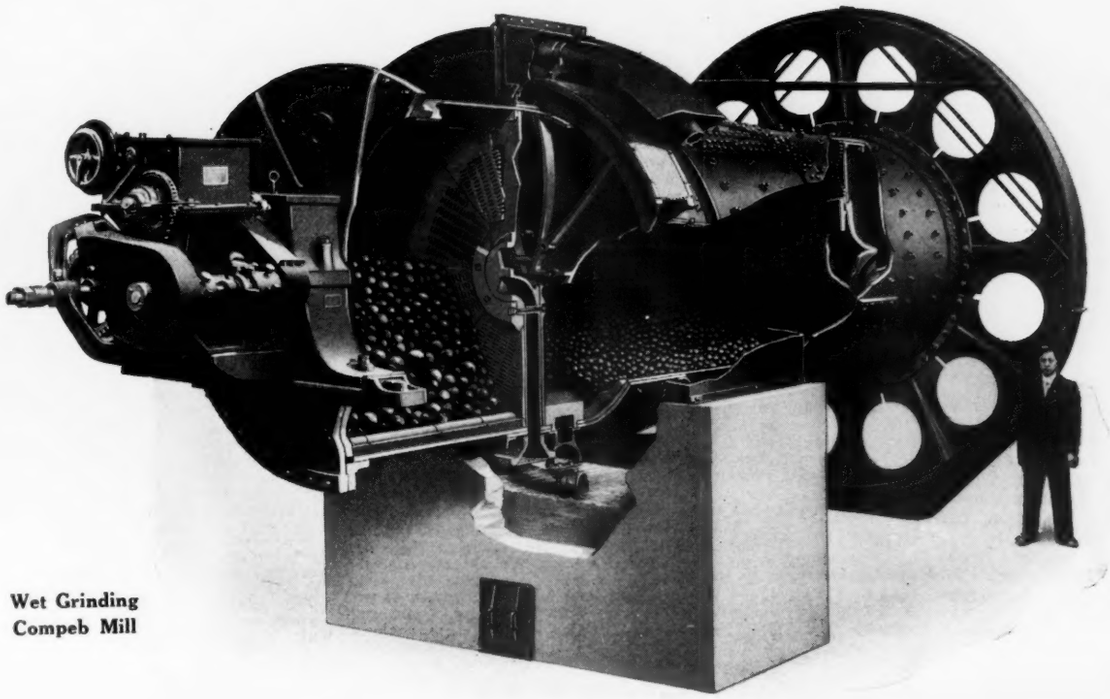
Government Price-Fixing of Sand and Gravel in Ontario

WESTERN ONTARIO municipalities and dredging companies which operate in the St. Clair River reached an agreement respecting the price to be charged for gravel when they met recently at the Parliament buildings, with Thomas Gibson, Deputy Minister of Mines, as an arbiter in their dispute. An increase in the price to be paid to the dredging companies was agreed upon by the municipalities on the stipulation that the gravel supplied in future is to be of the highest grade.

The dredging companies have been operating for several years past in the St. Clair River under instructions from the Dominion Government, the dredging being necessary for navigation purposes. The companies have been the source of supply for gravel for the municipalities until recently, when they complained that rates which had been fixed years ago were no longer adequate and should be accordingly revised. Refusal upon the part of the companies to continue the supply led to the conference with the municipalities. The Ontario Government was interested, since it collects a royalty on the gravel dredged, and it used its good offices to assist the conference in reaching an agreement which should be mutually satisfactory.—*Toronto* (Ont.) *Mail and Empire.*

British Columbia Rock and Gravel Enterprise

THE Cascade Rock and Gravel Co., Ltd., Vancouver, B. C., have plant and bunkers at the north end of the Second Narrows bridge. The company has 30 acres under lease and a plant with a capacity of 400 cu. yd. in eight hours. Electric motors, 400 hp. each, operate the crushing, screening, washing and conveying machinery. A dredged waterway permits direct loading into scows. The company also has a quarry at North Arm, where machinery is being installed. The president and general manager is W. Ellis; vice-president, A. L. Wilson; secretary-treasurer, W. J. Timlick, and W. R. Clift and W. E. Jenkins, directors.



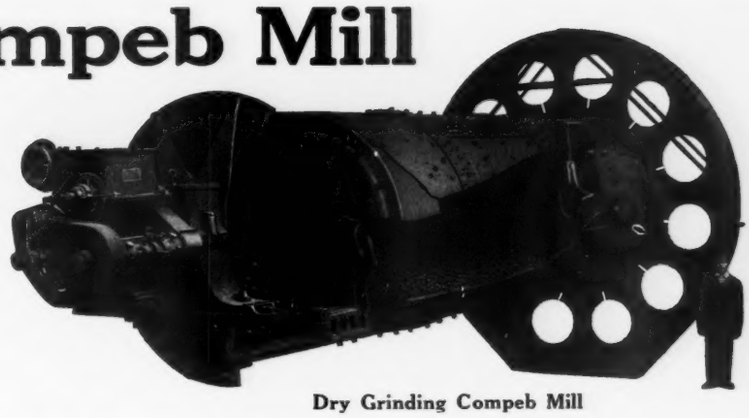
Wet Grinding
Compeb Mill

The Compeb Mill

Abolishes the necessity for a 2-stage reduction, which means a big saving in power, labor and installation cost.

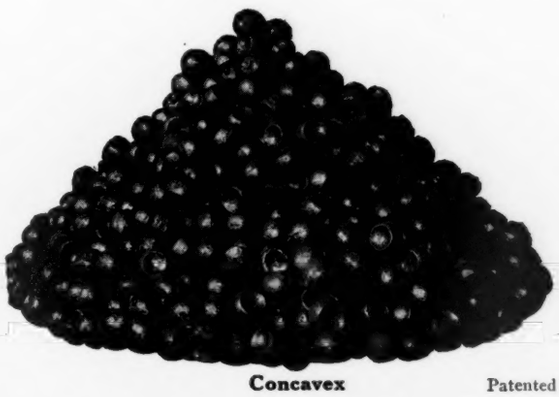
The grinding charge employed in the Compeb Mill consists of Forged Steel Balls in the preliminary compartment and Concavex in the finishing compartment.

The simple construction of the Compeb Mill and its slow speed (20 to 26 R. P. M.) insures low repair and maintenance expense with freedom from frequent shut downs.



Dry Grinding Compeb Mill

COMPEB MILLS CAN BE OPERATED CONTINUOUSLY 24 HOURS PER DAY.



Concavex Patented

On account of the interlocking shape of Concavex their angle of repose is much greater than that of any other grinding body, permitting of a lower charge being carried at a higher angle, and consequently is much better suited for use in existing tube mills where no new equipment is contemplated.

Write for Information

ALLIS-CHALMERS PRODUCTS
Electrical Machinery
Steam Turbines
Steam Engines
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Crushing and Cement Machinery
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MILWAUKEE, WISCONSIN, U.S.A.
District Offices in All Leading Cities.

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Flour and Saw Mill Machinery
Power Transmission Machinery
Pumping Engines-Centrifugal Pumps
Steam and Electric Hoists
Air Compressors - Air Brakes
Agricultural Machinery
Condensers

When writing advertisers, please mention ROCK PRODUCTS

News of All the Industry

Incorporations

James Sand and Gravel Co., Louisville, Ky., dissolved.

Auburn Concrete Products Co., Inc., Auburn, Wash., has increased its capital stock to $40,000.

Kendall Quarry and Construction Co., Kendall, Fla., $30,000. Fred B. Green, Jr., and others.

Muskee Sand Co., 30 North High St., Millville, N. J., $200,00. Deal in sand, gravel, etc.

Lime and Stone Co., Sand Springs, Okla., Box 743. C. Tingley, construction engineer.

Calcium Products, Ltd., Toronto, Ont., $40,000. Deal in agricultural lime, abrasives, etc.

Home Rock Co., Amarillo, Texas, $10,000. H. H. Folks, C. W. Carson, Jr.

Commonwealth Sand and Gravel Corp., Norfolk, Va. (Filed by John Twohy, 1002 Magnolia Ave.)

Bloomington Limestone Co., Bloomington, Ind., $300,000. To operate stone quarries and mills. S. C. Freese, R. H. Kelley and C. L. Rawles.

Winona Sand and Gravel Co., Inc., Winona, Minn., $150,000. By Emil Stephn of Winona and John J. Stephn of Minnesota City.

John J. Harris, Inc., Haddon Heights, N. J., 1000 shares. Deal in sand. J. L. Harris, S. E. Ellcott, F. B. Platt.

The New Castle Trucking Co., Newcastle, N. Y.,has changed its name to the Marchiano Sand and Gravel Co.

Limestone Products, Inc., Ocala, Fla. To develop limestone deposits near Santos and operate lime plant in conjunction.

Mississippi Concrete and Material Co., Jackson, Miss., $20,000. By J. H. Thompson, 734 North State St., and others.

The Marlo Trap Rock Co., Wilmington, Del., $600,000. To deal in trap rock and all other stones.

The Parks Granite and Power Co., Elkin, N. C., $100,000. J. B. Parks, Curran Smith and others.

United States Phosphoric Products Co., Wilmington, Del., $1,000,000. Deal in all kinds of minerals.

The Bessemer Cement Corp., Youngstown, Ohio, 500 shares no par; C. F. Smith, N. A. Emery, J. D. Huxley, Donald J. Lynn, Harry S. Manchester.

Peterson Roofing Tile and Concrete Products Co., Ltd., Beaverton, Ont. To manufacture concrete roofing tile and "Duntile" building units. A branch office has been opened at Toronto.

The Lewis County Gravel Co., Fords Prairie, Wash., $30,000. Frank C. Knowles and Ernest Rector of Centralia and W. E. Buell of Portland. To operate a gravel pit at Fords Prairie.

The Centerville Limestone Co., Centerville, Ohio, $40,000 preferred and 350 shares no par value. Elmer T. Walker, Mary A. Walker, Noel L. Greenlee, Edwin W. Ellis and Howard E. Mankin.

General Gypsum Co., Delaware, has been licensed to do business in Ontario. Deal in granite, stone, lime, gypsum, artificial stone, cement, brick, plaster, mortar, etc., also quarry projects. (G. M. Clark, Toronto, attorney.)

Headley Bros., Inc., Bloomington, Ind., $200,000, composed of 2000 shares $100 par. To engage in the stone industry and acquire and operate a mill. John W. Headley, Albert T. Headley and Dorie F. Headley.

Rapid Hardening Portland Cement Co., room 818, 300 N. La Salle St., Chicago, Ill., $100,000. Manufacture and deal in cement of all kinds, lime, limestone, etc. (Tyrrell, Higgins and Jamieson.)

Volunteer Portland Cement Co., Knoxville, Tenn., $1,250,000. Deal in cement, lime, plaster. J. Ross Hanahan, president; Howell J. Davis, vice-president. Local directors are Weston M. Fulton, C. M. Moore and Howell J. Davis. (Corporation Trust Co. of America.)

Quarries

American Blue Stone Co., Portageville, N. Y., has work in progress on an expansion and improvement program at its local Ambluco quarries, to include the installation of additional equipment. The property is being electrified.

Comox Limestone and Fertilizer Co., Ltd., Courtney, B. C., is now operating its new plant. The rock arrives by the Vancouver-Courtenay Transport Co.'s scow from Texada Island and is crushed at the company's plant on the Courtenay River. An analysis of the crushed limestone, which has just been received from Dr. Frank T. Shutt, Dominion chemist at Ottawa, gives the calcium carbonate content as 97¼%, and states that the product ranks with the best on record and that it is well suited for agricultural purposes. E. R. Bewell, the district agriculturist, who has done much in getting the farmers interested in lime, is enthusiastic over this method of improving the soil in the district, practically all of which, he says, was shown by experiments conducted last year to be deficient in lime. The very low cost of crushed limestone now enables most farmers to make use of this necessity.

Limestone Products Co., Mifflinburg, Penn., of which William D. Kochersperger and Brice O. Harter are officers, has secured another contract from the government for the erection of beacon lights for aeroplane routes. This contract covers the territory between Salt Lake City, Utah, and Los Angeles, Calif. This is the fourth contract which this company has had. Last year they completed similar work between New Brunswick, N. J., and Cleveland, Ohio. Last fall they completed another one between New York and Boston, Mass. Mr. Harter had charge of the erection of these lights on the route between Chicago, Ill., and Dallas, Tex.

John Oman, Chamber of Commerce Building, Crossville, Tenn., has leased property in Cumberland county to operate a quarry for building stone.

Whatcom County, Washington, has purchased a 13-ton gyratory crusher to be erected for a roadstone crushing plant. A heavy duty gas engine is being overhauled in the county garage to drive the crusher, which will be installed on an acre tract purchased by the county board at a cost of $200 from Mrs. Alice McDaniel, near Lawrence. Bunkers will be erected and a high-line installed to haul river rock to the crusher.

Kentucky River Sand and Stone Co. is installing a new crusher at their Tyrone quarry with a 150 ton per day capacity. This machine is being installed in conjunction with the other equipment.

Kentucky State Highway Department has made contracts for quarry sites on the Cincinnati-Lookout Mountain Air-Line highway. E. P. Singleton leased a site at the top of the river hill. Another site was leased from John Simpson and three sites were selected south of Burnside. Five rock crushers will be placed on the route from Somerset to the McCreary county line. These crushers will furnish rock for surfacing the road.

Canada Crushed Stone Corp., Ltd., Sun Life Building, Hamilton, Ont., is preparing plans for additional facilities at its Hagersville quarry.

Sand and Gravel

Ontario.—Municipalities purchasing gravel for roads from the dredging companies operating in the St. Clair river have agreed to a higher price. The dredging companies have been operating for several years in the St. Clair river under instructions from the Dominion government. The Ontario government collects a royalty on all the gravel sold by the dredging companies.

Missouri Gravel Co., La Grange, Mo., is soon to start repair work at its plant. Another conveyor will be added and a crusher installed, according to reports. C. D. Harvey is superintendent.

Ohio River Gravel Co., Parkersburg, W. Va., has added an electric whirley and hoist of large capacity for unloading sand and gravel barges to stock bins at its Market street plant.

Gemmer and Tanner have started grading work on the spur leading to the new gravel pits to be operated shortly at Eagle Lake, Texas. Two carloads of equipment for the new plant have been received and other machinery will be sent from the Columbus, Texas, plant. Operations are expected to start about April 15.

Standard Sand and Gravel Co., Wheeling, W. Va., held its annual stockholders meeting recently at which time the yearly report was read. The following were elected officers for the ensuing year: Walter M. Armstrong, president; W. T. Strump, vice-president and general manager; R. W. Marshall, treasurer, and Miss E. Gwennap, secretary. The directors elected are: W. H. Klieves, chairman; Walter Armstrong, W. P. Strump, R. W. Marshall, S. G. Pyle and D. E. Thoeman.

Hanenkrat Gravel Works, Warsaw, Mo., has completed arrangements for enlarging its operations and changing the plant location. A track will be run from the depot along the river bank. The dredge line, derricks, shovels and other machinery will be installed. Elmer Hays, local manager, was in Sedalia recently to complete arrangements for the moving of more machinery.

Delight, Ark.—Wolf Creek Sand and Gravel Co.'s large new plant here nears completion.

Winchester Sand and Gravel, Winchester, Ky., is contemplating the purchase of crushing equipment and sand washing apparatus. H. C. MacNeill is secretary.

Brant Sand and Gravel Co., Ltd., has purchased the plant and property of the Brantford Sand and Gravel Co., Brantford, Ont. It is the intention of the company to overhaul the present equipment and add some new machines. A three-deck Niagara shaker screen will be installed, together with complete new washing machinery. The plant will be equipped electrically throughout. Herbert McIntry will be in charge of operations.

Lime

Falling Spring Lime Co., Inc., Barber, Va., Guy G. Buell, general manager, recently organized, is arranging for the early installation of a new lime plant with capacity of about 400 tons of rock per day; to be increased to 1000 tons later. All machinery will be electrically-operated.

Southern Lime Products Co., Cincinnati, Ohio, has leased the Alabama Lime Works, Ft. Payne, Ala., for a period of 10 years. The company has started work on repairs and improvements to the plant and will put it into operation after an idleness of about three years. The two kilns of the plant will be enlarged and improved and a new stone crushing plant installed. H. C. Perry will be manager.

Gypsum

Windsor Gypsum Co., Nova Scotia, has plans under way for addition to its storage bins which when completed will give the company a winter storage capacity of about 100,000 tons of gypsum. The company is reported to be considering the erection of a modern refining plant.

Ft. Dodge, Iowa.—The deed transferring the property of the Carbon Plaster Co. to the United States Gypsum Co. has been filed at the office of County Recorder Ottosen. The deed is signed by N. J. Berkely, president of the Carbon Plaster Co. The total value of the plant, as indicated by the revenue stamps attached, is somewhere in the neighborhood of $10,000. This is the first deed to be filed by any of the local mills which have entered into the combine.

Atlantic Gypsum Products Corp., Portsmouth, N. H., at its recent annual meeting elected A. F. Bemis, Boston, chairman of the board and G. N. Roberts, Boston, president. Operations at the plant now building at Freeman's Point, N. H., will soon be under way, it is stated.

Cement

Lime Products Co., Home Insurance building, Little Rock, Ark., is reported to have engaged the Lund Engineering Co., same address, to prepare plans for a new mill for the manufacture of portland cement, near White Cliffs, Ark., to cost more than $400,000. A. B. Banks is president.

Cement Products

Lycoming Duntile Co., Williamsport, Penn., is now on a production basis and it is hoped in the very near future to put up the first Duntile building in that city—as soon as the weather permits. This building will no doubt be of glazed Duntile, as the prospect is very much sold on the effect of

Keeping Pace with the Times

More efficient stoking, more uniform coal consumption, and greater fuel economy—these have long been one of the goals of the lime industry.

Lime kilns have been great "coal-eaters" and the maximum work has never been obtained from the coal consumed. The Arnold Kiln, even under the old hand-stoking handicap, has always been noted for its comparatively low fuel consumption, but now still greater economy is afforded by the new developed Ward Automatic Stoker. Automatic stoking—less coal used—and better results obtained! Write for information.

Arnold and Weigel "Centralized Control" plant building services is known throughout the lime industry. Situated virtually in the center of the lime production area, we enjoy the advantages of intimate contact with the most progressive practices. On small problems or big ones—our engineers are ready to give you the most expert service.

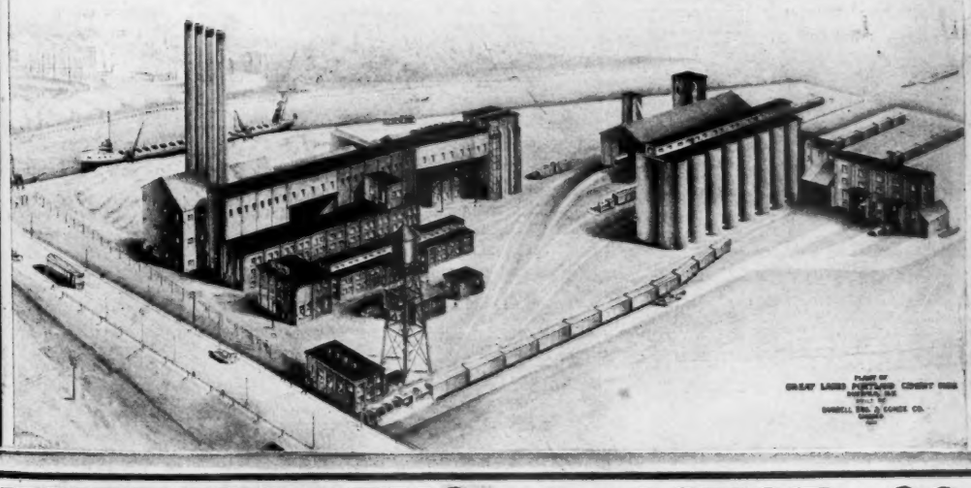
ARNOLD & WEIGEL

Contractors and Engineers

Woodville, Ohio

A TYPICAL **BURRELL** JOB

THIS 7000 BBL PLANT
NOW UNDER CONSTRUCTION FOR
THE GREAT LAKES PORTLAND CEMENT CORP.
AT BUFFALO N.Y.



BURRELL ENG. & CONST. CO.

ENGINEERS DESIGNERS OF INDUSTRIAL PLANTS BUILDERS

513 W. JACKSON BLVD. CHICAGO, ILL.

this most attractive colored block. A. R. Millhouse, general manager and treasurer of Kline & Co., Williamsport, one of the largest hardware houses in central Pennsylvania, is manager.

Silica Sand

Kentucky Silica Sand Co., Tip Top and Louisville, Ky., has been awarded judgment of $11,866 against the U. S. government by Judge Charles I. Dawson, federal court, Louisville, as compensation for land taken over by the government in 1918, as a part of the Dixie highway, through Camp Knox territory. The condemnation proceedings were started in 1925, seven years after the land was taken over. Three commissioners valued the land at $6,500, but other claims were allowed.

Browntown, Wis.—The drilling apparatus that has been operated to determine the extent of the silica sand deposit on the big hill just west of Browntown at the north edge of highway 20 has been dismantled following completion of testing. Robert Wehenn, lessee of the deposit, is reported to be satisfied with both quantity and quality of the silica sand. A company to produce and market the sand or build a glass plant in the locality is being considered by Mr. Wehenn, it is said.

Rock Phosphate

Harry D. Jackson and S. O. Serrott of Nampa, Idaho, returned recently following a six weeks' absence, bringing with them good news. During their absence they have visited the fertilizer markets of Portland, Seattle, Lemon Cove and San Francisco. The phosphate officials report that they are negotiating with a Portland fertilizer concern for a large amount of Bear Lake phosphate.

Talc

Blue Ridge Talc Co., Inc., Henry, Va., has just completed installation of a new Jeffrey hammer mill. The company has also electrified the plant, now using individual motor drives instead of steam power. These changes were made necessary by 34½% increase in "Blue Ridge" mortar color sales in 1926.

Slag

Birmingham Slag Co. is building a steel tipple at its Ensley, Ala., plant to replace one of wood construction. Allen and Garcia Co. are the engineers and Salmon and Cowin the contractors.

Personals

Clayton D. Quaw has been elected a director of the Giant Portland Cement Co., increasing the members of the board to 12.

Joseph G. Worker has been appointed general sales manager and elected to the board of directors of the American Engineering Co., Philadelphia, Penn. Mr. Worker has had a long experience in engineering and sales work and for the past five years has been assistant to the president of the American company. He is a graduate of the University of Illinois, a member of the A. S. M. E. and a former president of the Stoker Manufacturers' Association.

William Moran, who is to be the new superintendent of the Minter Co. of Milford, Mass., which recently purchased the old Webb quarry, has arrived to take charge of the work preparatory to opening the plant. Operations are expected to begin shortly to fill orders for crushed stone.

A. M. Genessee of the general offices of the Portland Cement Association recently made a comprehensive address on the portland cement industry of the United States before the Kiwanis Club of Parkersburg, W. Va.

Major L. E. Evans of Bridgeport, Conn., chief of the Connecticut National Guard staff and field engineer of the Portland Cement Association, addressed the Norwalk, Conn., Lions Club recently. He spoke in the interests of cement as a building material.

John L. Schnitzer, formerly chief chemist at the Atlas Portland Cement Co., and for the last 18 months with the International Shoe Co., Hannibal, Mo., as chemist, has accepted position as chief chemist with the Federal Portland Cement Co. in Buffalo, N. Y.

G. C. Flinn, superintendent of the American Cement Plaster Division, Fort Dodge, Iowa, of the Beaver Products Corp. for the last four years, is leaving soon for Akron, N. Y., to become superintendent of the Beaver company's plant there. W. W. Fischer, assistant superintendent during the period Mr. Flinn was in charge, has been advanced to his former chief's position.

C. A. Bingaman of La Grande, Ore., was elected president of the Black Marble and Lime Co. at the annual meeting held late in February. L. E. Jordan of Enterprise, Ore., was made vice-president and J. A. Burleigh, also of Enterprise, was elected secretary of the company. Others chosen to serve on the board of directors were S. D. Keltner of Enterprise, F. H. Gaulke and J. R. Leslie of Joseph, John Dean of Cove, William Roulet of Elgin and H. McGoldrick of Imbler.

A. T. Goldbeck, director, bureau of engineering, National Crushed Stone Association, has been named chairman of the committee on structural design of roads, Highway Research Board.

George M. Dyke, who for some time has been assistant secretary of the Chain Belt Co., has been appointed treasurer of Stearns Conveyor Co., Cleveland, Ohio, which some time ago was taken over by the Chain Belt Co., Milwaukee, through purchase of all capital stock. Mr. Dyke came with the Chain Belt Co. as comptroller and office manager. He has been succeeded by W. H. Brandt as assistant secretary of the Chain Belt Co.

Matt Brodie, manager for Asia of the Sullivan Machinery Co., sailed last week from San Francisco for Tokyo, following a three months' furlough in this country.

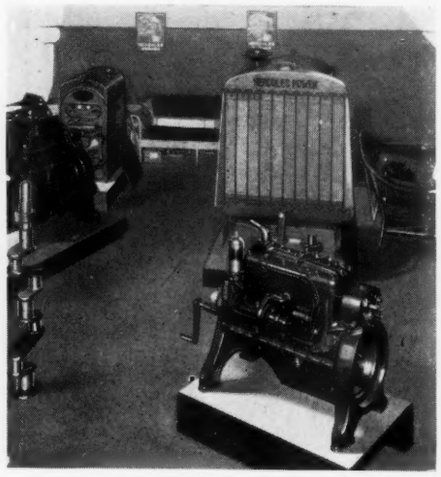
Obituaries

William P. Barker, Sr., aged 76 years, one of the founders of the Barker stone quarries and prominent in other industries at Batavia, Ill., for many years, died Feb. 28 in St. Francis hospital, Peoria, Ill.

Manufacturers

Sullivan Machinery Co., Chicago, announces the following changes and appointments: O. J. Neslage of the St. Louis office to the position of local manager of the Mexico City branch; C. W. Miller, special representative for Cuba; A. W. Oakes, formerly manager of the Mexico City branch, has been assigned to an American office.

Hercules Motors Corp., Canton, Ohio, exhibit at the recent Good Roads Show at Chicago, which consisted of several models of Hercules power units and engines, attracted many visitors. Several of the company engineers and salesmen were on hand



Engine exhibit at Chicago Road Show

to explain the construction and operation of the various models displayed.

Hyatt Roller Bearing Co., Newark, N. J., announces the appointments of H. O. K. Meister as general sales manager and A. W. Scarratt as chief engineer. Mr. Meister joined the Hyatt forces more than 14 years ago, locating first as an engineer at the house home office in Newark. Later he was transferred to the Chicago office, where after a few years he took over the supervision of Hyatt sales work in the western territory. Eighteen months ago Mr. Meister was appointed assistant sales manager and remained in headquarters at Newark, where he will continue to be located as general sales manager. Mr. Scarratt is well qualified to take over the duties of chief engineer on account of his past experience in the design and construction of automotive, tractor, railroad and industrial equipment. He joined the Hyatt engineer staff a few months ago as assistant chief engineer. Mr. Scarratt will remain at headquarters in Newark.

Botfield Refractories Co., Philadelphia, Penn., has appointed F. J. Donnelly sales representative in the New Jersey territory, with headquarters in New York.

Novo Engine Co., Lansing, Mich., has added the following new distributors: Contractors Sales Co., Inc., Albany, N. Y.; the Wheeler-Murray Co., Rochester, N. Y.; McCraken-Ripley Co., Portland, Ore.; Hudson Supply and Equipment Co., Washington, D. C., and the Construction Equipment Co., Columbia, S. C.

E. I. du Pont de Nemours & Co. announces that the New York office of its explosives department will be moved from its present quarters in the Equitable Building at 120 Broadway to the new Graybar Building, just east of the Grand Central Terminal, toward the end of April, when the present lease expires. The general executive offices of the company are at Wilmington, Del.

Burrell Engineering and Construction Co., Chicago, Ill., has been awarded the general contract by the Lawrence Portland Cement Co. for an addition to its plant at Thomaston, Me., formerly the works of the New England Lime and Cement Co. The proposed expansion is estimated to cost about $200,000 with equipment.

Blaw-Knox Co., Pittsburgh, Penn., announces the removal of its Philadelphia office from the Colonial Trust Building to 332 Widener Building in Philadelphia.

Link-Belt Co., Chicago, Ill., announces the opening of a new branch sales office at 229 Brown-Marx Building, Birmingham, Ala., with W. H. Norton as manager. H. R. Haught will assist in the sales.

Trade Literature

NOTICE—Any publication mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of the items kindly mention ROCK PRODUCTS.

Linerite. Bulletin No. **9585** on "Linerite," a rubber abrasion resisting compound for lining batch and rotary grinding mills in the cement, ceramic or other industries. Construction details and data on attachment and installation. B. F. GOODRICH RUBBER CO., Akron, Ohio.

G. E. Bulletins. GEA-588 on gear units for centrifugal compressors; **GEA-594** on automatic control panels for industrial electric heating; **GEA-708** on medium speed synchronous motors (7600 series) of the TS, QS types.

Rock Products Plant Equipment. Catalog No. **437** on Jeffrey equipment, including elevators (bucket and arm types), conveyors (bucket, apron, pan, drag chain, spiral and belt types), power shovels, apron and plate feeders, revolving screens, sand settling tanks, valves, chutes, pulverizers, manganoid grinding balls for tube mills, chains, sprockets, gears, portable loaders, and coal and ashes handling equipment for rock products plants. THE JEFFREY MFG. CO., Columbus, Ohio.

Engineering Design. Illustrated brochure showing some of the work of the engineering and designing department of STEACY-SCHMIDT MFG. CO., York, Penn.

Minneapolis Cement Products Manufacturers Celebrate

AS an old country festival of music, dancing and food, "A Night in Norway and Sweden" was held Saturday evening, February 19, in the Moorish room of the West Hotel, under the auspices of the Concrete Block Manufacturers Association of Minneapolis. Invitations to the affair were extended to the friends of the association members and to anybody who wanted to participate in a frolic that was like a festival in a village of Scandinavia. Harry A. Anderson is president of the association.

Norse and Swedish music, vocal and instrumental, was featured on the entertainment program. Old country dances were presented by groups and individuals in costumes.